ELEMENTARY
CORE Academy
UTAH STATE OFFICE OF EDUCATION & UTAH STATE UNIVERSITY

Participant Handbook

2006

UTAH STATE OFFICE OF EDUCATION

ELEMENTARY CORE ACADEMY

6517 Old Main Hill
Logan, UT 84322-6517

435-797-0939
http://coreacademy.usu.edu

UtahState UNIVERSITY

1-890563-71-4

Acknowledgements

These materials have been produced by and for the teachers of the State of Utah. Appreciation is expressed to the numerous individuals who provided input and effort into the creation of this curriculum. Delivery of the Elementary CORE Academy, including the development and delivery of content, coordination of sessions, distribution of materials, and participant interaction, has been a collaborative effort of many educational groups across Utah. The following organizations, Utah teachers, and educational leaders contributed ideas and activities as part of this professional development project:

Organizations:

Utah State Office of Education (USOE)
Utah State University (USU)
State Science Education Coordination Committee (SSECC)
State Mathematics Education Coordination Committee (SMECC)
Special Education Services Unit (USOE)
WestEd Eisenhower Regional Consortium

Individuals:

Academy Coordination Committee: Max Longhurst, Brett Moulding, Nicole Paulson, Velma Itamura, Janet Gibbs

Academy Director: Max Longhurst

Academy Coordinator: Megan Richards

Academy Facilitators and Contributors: Joel Frederiksen, Deanna Martineau, Patti Seeholzer, Carol Skousen

Academy Presenters: Susan Broschinsky, Liz Buchanan, Lindsay Hadfield, Tricia Holden, Sherri Madson, Cynthia Price, Susan Weiler

Credits for editing, compiling, formatting, and assisting with the materials and delivery of the Elementary CORE Academy are given to James Evans, Ami Israelsen, Eric Rowley, and Elizabeth Shaw.

UTAH STATE OFFICE OF EDUCATION

Leadership…Service…Accountability

Patti Harrington, Ed.D. State Superintendent of Public Instruction
Voice: (801) 538-7500 Fax: (801) 538-7521 TDD: (801) 538-7876
250 East Cesar E. Chavez Blvd. (500 South) P.O. Box 144200 Salt Lake City, Utah 84114-4200

Dear CORE Academy Teachers:

Thank you for your investment in children and in building your own expertise as you participate in the Elementary CORE Academy. I hope your involvement helps you to sustain a laser-like focus on student achievement.

Teachers in Utah are superb. By participating in the Academy, you join a host of teachers throughout the state who understand that teaching targeted on the core curricula, across a spectrum of subjects, will produce results of excellence. The research is quite clear–the closer the match of explicit instruction to core standards, the better the outcome on core assessments.

I personally appreciate your excellence and your desire to create wonderful classrooms of learning for students. Thank you for your dedication. I feel honored to associate with you and pledge my support to lead education in ways that benefit all of our children.

Sincerely,

Patti Harrington, Ed.D.
State Superintendent of Public Instruction

Funding Sources

Appreciation is expressed for the tremendous educational input and monetary commitment of several organizations for the successful delivery of the Elementary CORE Academy. This year's Elementary CORE Academy was developed and funded through a variety of sources. The Utah State Office of Education (USOE), in collaboration with Utah State University (USU) and local school districts of Utah, have supported kindergarten through sixth grade teachers with professional development experiences that will enhance the educational experience for Utah children.

Major funding for the Academy comes from the following sources:

Federal/State Funds:

Utah State Office of Education
- Staff Development Funds
- Special Education Services Unit

ESEA Title II

Utah Math Science Partnership

WestED Eisenhower Regional Consortium

District Funds:

Various sources including Quality Teacher Block, Federal ESEA Title II, and District Professional Development Funds

School Funds:

Trust land, ESEA Title II, and other school funds
Utah State Office of Education Special Education Services

The state and district funds are allocations from the state legislature. ESEA is part of the "No Child Left Behind" funding that comes to Utah.

Additionally, numerous school districts, individual schools, and principals in Utah have sponsored teachers to attend the Academy. Other educational groups such as the Utah Division of Water Resources, National Energy Foundation, Utah Energy Office, and the Utah Mining Association have assisted in the development and delivery of resources in the Academy.

Most important is the thousands of teachers who take time from their summer to attend these professional development workshops. It is these teachers who make this program possible.

Goals of the Elementary CORE Academy

Overall

The purpose of the Elementary CORE Academy is to create high quality teacher instruction and improve student achievement through the delivery of professional development opportunities and experiences for teachers across Utah.

The Academy will provide elementary teachers in Utah with:

1. Models of exemplary and innovative instructional strategies, tools, and resources to meet the Core Curriculum standards, objectives, and indicators.
2. Practical models and diverse methods of meeting the learning needs of all children, with instruction implementation aligned to the Core Curriculum.
3. Meaningful opportunities for collaboration, self-reflection, and peer discussion specific to innovative and effective instructional techniques, materials, teaching strategies, and professional practices in order to improve classroom instruction.

Learning a limited set of facts will no longer prepare a student for real experiences encountered in today's world. It is imperative that educators have continued opportunities to obtain instructional skills and strategies that provide methods of meeting the needs of all students. Participants of the Academy experience will be better equipped to meet the challenges faced in today's classrooms.

Table of Contents

Chapter 1: Third Grade Mathematics and Science Core Curriculum

Chapter 2: Facilitated Activities

Chapter 3: Math III-1,2,&3 Activities - Spatial Reasoning

Chapter 4: Science I-1&2 Activities - Earth & Moon

Chapter 5: Math I-2,3,4,&5 Activities - Number Sense

Chapter 6: Science V-1&3 Activities - Sun: Main Source of Heat

Chapter 7: Math IV-1&2 Activities - Measurement

Chapter 8: Science II-1&2 Activities - Living/Non Living

Appendix

Third Grade
Mathematics and Science
Core Curriculum

Utah Elementary Mathematics Core Curriculum

Introduction

Most students enter school confident in their own abilities; they are curious and eager to learn more. They make sense of the world by reasoning and problem solving. Young students are active, resourceful individuals who construct, modify, and integrate ideas by interacting with the physical world as well as with peers and adults. They learn by doing, collaborating, and sharing their ideas. Students' abilities to communicate through language, pictures, sound, movement, and other symbolic means develop rapidly during these years.

- Mathematics instruction needs to include more than short-term learning of rote procedures.

Young students are building beliefs about what mathematics is, about what it means to know and do mathematics, and about themselves as mathematical learners. Mathematics instruction needs to include more than short-term learning of rote procedures. Students must use technology and other mathematical tools, such as manipulative materials, to develop conceptual understanding and solve problems as they do mathematics. Students, as mathematicians, learn best with hands-on, active experiences throughout the instruction of the mathematics curriculum.

Recognizing that no term captures completely all aspects of expertise, competence, knowledge, and facility in mathematics, the term mathematical proficiency has been chosen to capture what it means to learn mathematics successfully. Mathematical proficiency has five strands: computing (carrying out mathematical procedures flexibly, accurately, efficiently, and appropriately), understanding (comprehending mathematical concepts, operations, and relations), applying (ability to formulate, represent, and solve mathematical problems), reasoning (using logic to explain and justify a solution to a problem), and engaging (seeing mathematics as sensible, useful, and doable, and being able to do the work).

The most important observation about the five strands of mathematical proficiency is that they are interwoven and interdependent. This observation has implications for how students acquire mathematical proficiency, how teachers develop that proficiency in their students, and how teachers are educated to achieve that goal. At any given moment during a mathematics lesson or unit, one or two strands might be emphasized. But all the strands must eventually be addressed so that the links among them are strengthened. The integrated and balanced development of all five strands of

mathematical proficiency should guide the teaching and learning of school mathematics. Instruction should not be based on extreme positions that students learn solely by internalizing what a teacher or book says or solely by inventing mathematics on their own.

The Elementary Mathematics Core describes what students should know and be able to do at the end of each of the K-6 grade levels. It was developed, critiqued, and revised by a community of Utah mathematics teachers, university mathematics educators, State Office of Education specialists, mathematicians, and an advisory committee representing a wide variety of people from the community. The Core reflects the current philosophy of mathematics education that is expressed in national documents developed by the National Council of the Teachers of Mathematics, the American Association for the Advancement of Science, and the National Research Council. This Mathematics Core has the endorsement of the Utah Council of Teachers of Mathematics Association. The Core reflects high standards of achievement in mathematics for all students.

Organization of the Elementary Mathematics Core

The Core is designed to help teachers organize and deliver instruction.

- The INTENDED LEARNING OUTCOMES (ILOs) describe the goals for mathematical skills and attitudes. They are found at the beginning of each grade level, are an integral part of the Core, and should be included as part of instruction.
- A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- An INDICATOR is a measurable or observable student action that enables one to assess whether a student has mastered a particular Objective. Indicators are not meant to be classroom activities, but they can help guide classroom instruction.

Guidelines Used in Developing the Elementary Mathematics Core

The Core is:

Consistent With the Nature of Learning

The main intent of mathematics instruction is for students to value and use mathematics as a process to understand the world. The Core is designed to produce an integrated set of Intended Learning Outcomes for students.

Coherent

The Core has been designed so that, wherever possible, the ideas taught within a particular grade level have a logical and natural connection with each other and with those of earlier grades. Efforts have also been made to select topics and skills that integrate well with one another and with other subject areas appropriate to grade level. In addition, there is an upward articulation of mathematical concepts, skills, and content. This spiraling is intended to prepare students to understand and use more complex mathematical concepts and skills as they advance through the learning process.

Developmentally Appropriate

The Core takes into account the psychological and social readiness of students. It builds from concrete experiences to more abstract understandings. The Core focuses on providing experiences with concepts that students can explore and understand in depth to build the foundation for future mathematical learning experiences.

Reflective of Successful Teaching Practices

Learning through play, movement, and adventure is critical to the early development of the mind and body. The Core emphasizes student exploration. The Intended Learning Outcomes are central in each standard. The Core is designed to encourage instruction with students working in cooperative groups. Instruction should include recognition of the role of mathematics in the classroom, school, and community.

Comprehensive

The Elementary Mathematics Core does not cover all topics that have traditionally been in the elementary mathematics curriculum; however, it provides a comprehensive background in mathematics. By emphasizing depth rather than breadth, the Core seeks to empower students rather than intimidate them with a collection of isolated and eminently forgettable facts. Teachers are free to add related concepts

The Core is:

- Consistent
- Coherent
- Developmentally Appropriate
- Reflective of Successful Teaching Practices
- Comprehensive
- Feasible
- Useful and Relevant
- Reliant Upon Effective Assessment Practices
- Engaging

and skills, but they are expected to teach all the standards and objectives specified in the Core for their grade level.

Feasible

Teachers and others who are familiar with Utah students, classrooms, teachers, and schools have designed the Core. It can be taught with easily obtained resources and materials. A Teacher Handbook is also available for teachers and has sample lessons on each topic for each grade level. The Teacher Handbook is a document that will grow as teachers add exemplary lessons aligned with the new Core.

Useful and Relevant

This curriculum relates directly to student needs and interests. Relevance of mathematics to other endeavors enables students to transfer skills gained from mathematics instruction into their other school subjects and into their lives outside the classroom.

Reliant Upon Effective Assessment Practices

Student achievement of the standards and objectives in this Core is best assessed using a variety of assessment instruments. Performance tests are particularly appropriate to evaluate student mastery of mathematical processes and problem-solving skills. Teachers should use a variety of classroom assessment approaches in conjunction with standard assessment instruments to inform instruction. Sample test items, keyed to each Core Standard, may be located on the "Utah Mathematics Home Page" at http://www.usoe.k12.ut.us/curr/math. Observation of students engaged in instructional activities is highly recommended as a way to assess students' skills as well as attitudes toward learning. The nature of the questions posed by students provides important evidence of their understanding of mathematics.

Engaging

In the early grades, children are forming attitudes and habits for learning. It is important that instruction maximizes students' potential and gives them understanding of the intertwined nature of learning. Effective elementary mathematics instruction engages students actively in enjoyable learning experiences. Instruction should be as thrilling an experience for a child as seeing a rainbow, growing a flower, or describing a toad. In a world of rapidly expanding knowledge and technology, all students must gain the skills they will need to understand and function responsibly and successfully in the world. The Core provides skills in a context that enables students to experience the joy of learning.

Intended Learning Outcomes for Third Grade Mathematics

The main intent of mathematics instruction is for students to value and use mathematics and reasoning skills to investigate and understand the world.

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of mathematics instruction. They are an essential part of the Mathematics Core Curriculum and provide teachers with a standard for evaluation of student learning in mathematics. Significant mathematics understanding occurs when teachers incorporate ILOs in planning mathematics instruction.

- ILOs describe the skills and attitudes students should learn as a result of mathematics instruction.

By the end of third grade students will be able to:

1. **Demonstrate a positive learning attitude toward mathematics.**
   a. Display a sense of curiosity about numbers and patterns.
   b. Pose mathematical questions about objects, events, and processes.
   c. Demonstrate persistence in completing tasks.
   d. Apply prior knowledge and processes to construct new knowledge.
   e. Maintain an open and questioning mind toward new ideas and alternative points of view.
2. **Become mathematical problem solvers.**
   a. Determine the approach, materials, and strategies to be used in setting up a problem.
   b. Model problem situations in a variety of ways.
   c. Develop understanding of new mathematical concepts and vocabulary by answering questions such as: What made you think that? Did anyone think of this in a different way? Where have we seen a problem like this before?
   d. Construct and use concrete, pictorial, symbolic, and graphical models to represent problem situations.
   e. Know when to select and how to use grade-appropriate mathematical tools and methods as a natural and routine part of the problem-solving process.
   f. Build new mathematical knowledge through problem solving.
   g. Solve problems in both mathematical and everyday contexts.
   h. Recognize that there may be multiple ways to solve a problem.

3. **Reason mathematically.**
   a. Draw logical conclusions and make generalizations.
   b. Determine the approach, materials, and strategies to be used in solving problems.
   c. Use models, known facts, and relationships to explain reasoning.
   d. Make precise calculations and check the validity of the results in the context of the problem.
   e. Analyze mathematical situations by recognizing and using patterns and relationships.
   f. Justify answers and solution processes.
4. **Communicate mathematically.**
   a. Represent mathematical ideas with objects, pictures, and symbols.
   b. Express mathematical ideas to peers, teachers, and others through oral and written language.
   c. Engage in mathematical discussions through brainstorming, asking questions, and sharing strategies for solving problems.
   d. Explain mathematical work and justify reasoning and conclusions.
5. **Make mathematical connections.**
   a. Use one mathematical idea to extend understanding of another.
   b. Recognize the role of mathematics in the classroom, school, and community.
   c. Explore problems and describe and confirm results using various representations.
6. **Represent mathematical situations.**
   a. Create and use representations to organize and communicate mathematical ideas.
   b. Represent mathematical concepts using concrete, pictorial, and symbolic models.

Third Grade Mathematics Core Curriculum

Standard I: Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 1: Represent whole numbers in a variety of ways.

a. Model, read, and write whole numbers up to 10,000 using base ten models, pictures, and symbols.

b. Write a numeral when given the number of thousands, hundreds, tens, and ones.

c. Write a number up to 9,999 in expanded form (e.g., 6,539 is 6 thousands, 5 hundreds, 3 tens, and 9 ones or 6000+500+30+9).

d. Identify the place and the value of a given digit in a four-digit numeral.

e. Demonstrate multiple ways to represent numbers using models and symbolic representations (e.g., fifty is the same as two groups of 25, the number of pennies in five dimes, or 75-25).

Objective 2: Identify relationships among whole numbers.

a. Use a variety of strategies to determine whether a number is even or odd.

b. Identify the number that is ten more, ten less, 100 more, or 100 less than any whole number up to 1,000.

c. Compare the relative size of numbers (e.g., 31 is large compared to 4, about half as big as 60, close to 27).

d. Compare whole numbers up to four digits using the symbols <, >, and =.

e. Order and compare whole numbers on a number line.

Objective 3: Model and illustrate meanings of the operations of addition, subtraction, multiplication, and division and describe how they relate.

a. Model addition and subtraction of two- and three-digit whole numbers in a variety of ways.

b. Model multiplication of a one-digit factor by a one-digit factor using various methods (e.g., repeated addition,

Standard I:
Students will acquire number sense and perform operations with whole numbers and simple fractions.

rectangular arrays, manipulatives, pictures) and connect the representation to an algorithm.

c. Model division as sharing equally and as repeated subtraction using various methods (e.g., rectangular arrays, manipulatives, number lines, pictorial representations).

d. Demonstrate, using objects, that multiplication and division are inverse operations (e.g., 3x4=12; thus, 12÷4=3 and 12÷3=4).

e. Select and write an addition, subtraction, or multiplication sentence to solve a problem related to the students' environment, and write a story problem that relates to a given equation.

f. Demonstrate the effect of place value when multiplying whole numbers by 10.

Objective 4: Use fractions to communicate parts of the whole.

a. Identify the denominator of a fraction as the number of equal parts in the whole region or set.

b. Identify the numerator of a fraction as the number of equal parts being considered.

c. Divide regions and sets of objects into equal parts using a variety of objects, models, and illustrations.

d. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, sixths, and eighths.

e. Determine which of two fractions is greater using models or illustrations.

Objective 5: Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.

a. Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator).

b. Find the sum of any two addends with three or fewer digits, including monetary amounts, and describe the process used.

c. Find the difference of two-digit whole numbers and describe the process used.

d. Find the products for multiplication facts through ten times ten and describe the process used.

Standard II: Students will use patterns and relations to represent mathematical situations.

Objective 1: Recognize and create patterns with given attributes.

a. Create and extend repeating and growing patterns using objects, numbers, and tables.

b. Record results of patterns created using manipulatives, pictures, and numeric representations and describe how they are extended.

Objective 2: Recognize and represent mathematical situations using patterns and symbols.

a. Recognize that symbols such as □, △, or ◇ in an addition, subtraction, or multiplication equation, represent a value that will make the statement true (e.g., 5+7=△, □-3=6, ◇=2x4).

b. Solve equations involving equivalent expressions (e.g., 6+4 = □+7).

c. Use the >, <, and = symbols to compare two expressions involving addition and subtraction (e.g., 4+6 □ 3+2; 3+5 ◇ 16-9).

d. Demonstrate that grouping three or more addends does not change the sum (e.g., 3+(2+7)=12, (7+3)+2=12) and changing the order of factors does not change the product (e.g., 3x7=21, 7x3=21).

e. Use a variety of manipulatives to model the identity property of addition (e.g., 3+0=3), the identity property of multiplication (e.g., 7x1=7), and the zero property of multiplication (e.g., 6x0=0).

Standard II: Students will use patterns and relations to represent mathematical situations.

Standard III: Students will use spatial reasoning to describe, identify, and create geometric shapes.

Standard III: Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 1: Describe, identify, and create geometric shapes.

a. Identify and draw points, lines, line segments, and endpoints.

b. Identify and draw lines of symmetry on triangles, squares, circles, and rectangles.

c. Determine whether an angle is right, obtuse, or acute by comparing the angle to the corner of a rectangle.

d. Classify polygons (e.g., quadrilaterals, pentagons, hexagons, octagons) by the number of sides and corners.

e. Identify, make, and describe cubes (e.g., a cube has six square faces, eight vertices, and twelve edges).

Objective 2: Describe spatial relationships.

a. Give directions to reach a location.

b. Use coordinates (A, 1) or regions to locate positions on a map.

c. Demonstrate and use horizontal and vertical lines.

Objective 3: Visualize and identify geometric shapes after applying transformations.

a. Demonstrate the effect of a slide (translation) or flip (reflection) on a figure, using manipulatives.

b. Determine whether two polygons are congruent by sliding, flipping, or turning to physically fit one object on top of the other.

c. Identify two-dimensional shapes (nets) that will fold to make a cube.

d. Create a polygon that results from combining other polygons.

Standard IV: Students will understand and use measurement tools and techniques.

Objective 1: Identify and describe measurable attributes of objects and units of measurement.

a. Recognize the two systems of measurement: metric and customary.

b. Describe the relationship between metric units of length (i.e., centimeter, meter).

c. Describe the relationship among customary units of length (i.e., inch, foot, yard) and the relationship between customary units of capacity (i.e., cup, quart).

d. Estimate length, capacity, and weight using metric and customary units.

Objective 2: Use appropriate techniques and tools to determine measurements.

a. Measure the length of objects to the nearest centimeter, meter, half-inch, foot, and yard.

b. Measure capacity using cups and quarts, and measure weight using pounds.

c. Determine the value of a combination of coins and bills that total $5.00 or less and write the monetary amounts using the dollar sign and decimal notation.

d. Identify the number of hours in a day, the number of days in a year, and the number of weeks in a year.

e. Read, tell, and write time to the quarter-hour.

f. Identify any given day of the month (e.g., the third Wednesday of the month is the 18th).

g. Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer.

h. Estimate and measure the perimeter and area of rectangles by measuring with nonstandard units.

Standard V: Students will collect and organize data to make predictions and identify basic concepts of probability.

Objective 1: Collect, organize, and display data to make predictions.

a. Collect, read, represent, and interpret data using tables, graphs, and charts, including keys (e.g., pictographs, bar graphs).

b. Make predictions based on a data display.

Standard V: Students will collect and organize data to make predictions and identify basic concepts of probability.

Objective 2: Identify basic concepts of probability.

a. Describe the results of events using the terms "certain," "equally likely," and "impossible."

b. Predict outcomes of simple activities (e.g., a bag contains three red marbles and five blue marbles. If one marble is selected, is it more likely to be red or blue?).

Utah Elementary Science Core Curriculum

Introduction

Science is a way of knowing, a process for gaining knowledge and understanding of the natural world. The Science Core Curriculum places emphasis on understanding and using skills. Students should be active learners. It is not enough for students to read about science; they must do science. They should observe, inquire, question, formulate and test hypotheses, analyze data, report, and evaluate findings. The students, as scientists, should have hands–on, active experiences throughout the instruction of the science curriculum.

- Science is a way of knowing, a process for gaining knowledge and understanding of the natural world.

The Elementary Science Core describes what students should know and be able to do at the end of each of the K–6 grade levels. It was developed, critiqued, piloted, and revised by a community of Utah science teachers, university science educators, State Office of Education specialists, scientists, expert national consultants, and an advisory committee representing a wide variety of people from the community. The Core reflects the current philosophy of science education that is expressed in national documents developed by the American Association for the Advancement of Science, the National Academies of Science. This Science Core has the endorsement of the Utah Science Teachers Association. The Core reflects high standards of achievement in science for all students.

Organization of the Elementary Science Core

The Core is designed to help teachers organize and deliver instruction.

The Science Core Curriculum's organization:

- Each grade level begins with a brief course description.
- The INTENDED LEARNING OUTCOMES (ILOs) describe the goals for science skills and attitudes. They are found at the beginning of each grade, and are an integral part of the Core that should be included as part of instruction.
- The SCIENCE BENCHMARKS describe the science content students should know. Each grade level has three to five Science Benchmarks. The ILOs and Benchmarks intersect in the Standards, Objectives and Indicators.

- A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they are judged to have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- An INDICATOR is a measurable or observable student action that enables one to judge whether a student has mastered a particular Objective. Indicators are not meant to be classroom activities, but they can help guide classroom instruction.

Guidelines

- Reflects the Nature of Science
- Coherent
- Developmentally Appropriate
- Encourages Good Teaching Practices
- Comprehensive
- Feasible
- Useful and Relevant
- Encourages Good Assessment Practices
- The Most Important Goal

Eight Guidelines Were Used in Developing the Elementary Science Core

Reflects the Nature of Science

Science is a way of knowing, a process of gaining knowledge and understanding of the natural world. The Core is designed to produce an integrated set of Intended Learning Outcomes (ILOs) for students. Please see the Intended Learning Outcomes document for each grade level core.

As described in these ILOs, students will:

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.
5. Demonstrate awareness of the social and historical aspects of science.
6. Understand the nature of science.

Coherent

The Core has been designed so that, wherever possible, the science ideas taught within a particular grade level have a logical and natural connection with each other and with those of earlier grades. Efforts have also been made to select topics and skills that integrate well with one another and with other subject areas appropriate to grade level. In addition, there is an upward articulation of science concepts, skills, and content. This spiraling is intended to prepare

students to understand and use more complex science concepts and skills as they advance through their science learning.

Developmentally Appropriate

The Core takes into account the psychological and social readiness of students. It builds from concrete experiences to more abstract understandings. The Core describes science language students should use that is appropriate to each grade level. A more extensive vocabulary should not be emphasized. In the past, many educators may have mistakenly thought that students understood abstract concepts (such as the nature of the atom), because they repeated appropriate names and vocabulary (such as electron and neutron). The Core resists the temptation to tell about abstract concepts at inappropriate grade levels, but focuses on providing experiences with concepts that students can explore and understand in depth to build a foundation for future science learning.

Encourages Good Teaching Practices

It is impossible to accomplish the full intent of the Core by lecturing and having students read from textbooks. The Elementary Science Core emphasizes student inquiry. Science process skills are central in each standard. Good science encourages students to gain knowledge by doing science: observing, questioning, exploring, making and testing hypotheses, comparing predictions, evaluating data, and communicating conclusions. The Core is designed to encourage instruction with students working in cooperative groups. Instruction should connect lessons with students' daily lives. The Core directs experiential science instruction for all students, not just those who have traditionally succeeded in science classes. The vignettes listed on the "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science for each of the Core standards provide examples, based on actual practice, that demonstrate that excellent teaching of the Science Core is possible.

Comprehensive

The Elementary Science Core does not cover all topics that have traditionally been in the elementary science curriculum; however, it does provide a comprehensive background in science. By emphasizing depth rather than breadth, the Core seeks to empower students rather than intimidate them with a collection of isolated and eminently forgettable facts. Teachers are free to add related concepts and skills, but they are expected to teach all the standards and objectives specified in the Core for their grade level.

Feasible

Teachers and others who are familiar with Utah students, classrooms, teachers, and schools have designed the Core. It can be taught with easily obtained resources and materials. A Teacher Resource Book (TRB) is available for elementary grades and has sample lessons on each topic for each grade level. The TRB is a document that will grow as teachers add exemplary lessons aligned with the new Core. The middle grade levels have electronic textbooks available at the Utah State Office of Education's "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science.

Useful and Relevant

This curriculum relates directly to student needs and interests. It is grounded in the natural world in which we live. Relevance of science to other endeavors enables students to transfer skills gained from science instruction into their other school subjects and into their lives outside the classroom.

Encourages Good Assessment Practices

Student achievement of the standards and objectives in this Core are best assessed using a variety of assessment instruments. One's purpose should be clearly in mind as assessment is planned and implemented. Performance tests are particularly appropriate to evaluate student mastery of science processes and problem-solving skills. Teachers should use a variety of classroom assessment approaches in conjunction with standard assessment instruments to inform their instruction. Sample test items, keyed to each Core Standard, may be located on the Utah Science Home Page. Observation of students engaged in science activities is highly recommended as a way to assess students' skills as well as attitudes in science. The nature of the questions posed by students provides important evidence of students' understanding of science.

The Most Important Goal

Elementary school reaches the greatest number of students for a longer period of time during the most formative years of the school experience. Effective elementary science instruction engages students actively in enjoyable learning experiences. Science instruction should be as thrilling an experience for a child as seeing a rainbow, growing a flower, or holding a toad. Science is not just for those who have traditionally succeeded in the subject, and it is not just for those who will choose science–related careers. In a world of rapidly expanding knowledge and technology, all students must gain the skills they will need to understand and function responsibly and successfully in the world. The Core provides skills in a context that enables students to experience the joy of doing science.

Third Grade Science Core Curriculum

In third grade students learn about interactions, relationships, relative motion, and cause and effect. They study the movement of Earth and the moon. They begin to learn of forces that move things; they learn of heat and light. Third graders observe, classify, predict, measure, and record.

Third graders should be encouraged to be curious. They should be helped and encouraged to pose their own questions about objects, events, processes, and results. Effective teachers provide students with hands-on science investigations in which student inquiry is an important goal. Teachers should provide opportunities for all students to experience many things. Third graders should use their senses as they feel the warmth of the sun on their face, watch the moon as it seems to move through broken clouds, sort and arrange their favorite rocks, look for patterns in rocks and flowers, observe a snail move ever so slowly up the side of a terrarium, test materials for slipping and sliding, measure the speed of rolling objects, and invent ways to resist gravity. They should come to enjoy science as a process of learning about the world.

- Personal relevance of science in students' lives is always an important part of helping students to value science, and should be emphasized at this grade level.

Third grade Core concepts should be integrated with concepts and skills from other curriculum areas. Reading, writing, and mathematics skills should be emphasized as integral to the instruction of science. Personal relevance of science in students' lives is always an important part of helping students to value science, and should be emphasized at this grade level.

This Core was designed using the American Association for the Advancement of Science's Project 2061: Benchmarks For Science Literacy and the National Academy of Science's National Science Education Standards as guides to determine appropriate content and skills.

The third grade Science Core has three online resources designed to help with classroom instruction; they include Teacher Resource Book – a set of lesson plans, assessment items and science information specific to third grade; Sci-ber Text – an electronic science text book specific to the Utah Core; and the science test item pool. This pool includes multiple-choice questions, performance tasks, and interpretive items aligned to the standards and objectives of the third grade curriculum. These resources are all available on the Utah Science Home Page at: http://www.usoe.k12.ut.us/curr/science

SAFETY PRECAUTIONS:

The hands–on nature of this science curriculum increases the need for teachers to use appropriate precautions in the classroom and field. Teachers must adhere to the published guidelines for the proper use of animals, equipment, and chemicals in the classroom. These guidelines are available on the Utah Science Home Page.

Intended Learning Outcomes for Third Grade Science

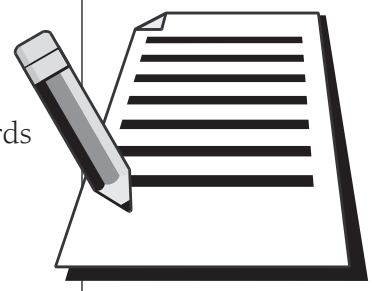
The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

- Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

By the end of third grade students will be able to:

1. **Use Science Process and Thinking Skills**
   a. Observe simple objects and patterns and report their observations.
   b. Sort and sequence data according to a given criterion.
   c. Make simple predictions and inferences based upon observations.
   d. Compare things and events.
   e. Use instruments to measure length, temperature, volume, and weight using appropriate units.
   f. Conduct a simple investigation when given directions.
   g. Develop and use simple classification systems.
   h. Use observations to construct a reasonable explanation.
2. **Manifest Scientific Attitudes and Interests**
   a. Demonstrate a sense of curiosity about nature.
   b. Voluntarily read or look at books and other materials about science.
   c. Pose questions about objects, events, and processes.
3. **Understand Science Concepts and Principles**
   a. Know science information specified for their grade level.
   b. Distinguish between examples and non-examples of science concepts taught.
   c. Explain science concepts and principles using their own words and explanations.
4. **Communicate Effectively Using Science Language and Reasoning**



a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).
b. Report observation with pictures, sentences, and models.
c. Use scientific language appropriate to grade level in oral and written communication.
d. Use available reference sources to obtain information.

Third Grade Science Standards

Science Benchmark

Earth orbits around the sun, and the moon orbits around Earth. Earth is spherical in shape and rotates on its axis to produce the night and day cycle. To people on Earth, this turning of the planet makes it appear as though the sun, moon, planets, and stars are moving across the sky once a day. However, this is only a perception as viewed from Earth.

Standard I: Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Standard I: Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Objective 1: Describe the appearance of Earth and the moon.

a. Describe the shape of Earth and the moon as spherical.

b. Explain that the sun is the source of light that lights the moon.

c. List the differences in the physical appearance of Earth and the moon as viewed from space.

Objective 2: Describe the movement of Earth and the moon and the apparent movement of other bodies through the sky.

a. Describe the motions of Earth (i.e., the rotation [spinning] of Earth on its axis, the revolution [orbit] of Earth around the sun).

b. Use a chart to show that the moon orbits Earth approximately every 28 days.

c. Use a model of Earth to demonstrate that Earth rotates on its axis once every 24 hours to produce the night and day cycle.

d. Use a model to demonstrate why it seems to a person on Earth that the sun, planets, and stars appear to move across the sky.

Science language students should use:

model, orbit, sphere, moon, axis, rotation, revolution, appearance

Science Benchmark

For any particular environment, some types of plants and animals survive well, some survive less well and some cannot survive at all. Organisms in an environment interact with their environment. Models can be used to investigate these interactions.

Standard II: Students will understand that organisms depend on living and nonliving things within their environment.

Standard II: Students will understand that organisms depend on living and nonliving things within their environment.

Objective 1: Classify living and nonliving things in an environment.

a. Identify characteristics of living things (i.e., growth, movement, reproduction).

b. Identify characteristics of nonliving things.

c. Classify living and nonliving things in an environment.

Objective 2: Describe the interactions between living and nonliving things in a small environment.

a. Identify living and nonliving things in a small environment (e.g., terrarium, aquarium, flowerbed) composed of living and nonliving things.

b. Predict the effects of changes in the environment (e.g., temperature, light, moisture) on a living organism.

c. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living organisms and nonliving things in a small–scale environment.

d. Compare a small–scale environment to a larger environment (e.g., aquarium to a pond, terrarium to a forest).

e. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Science language students should use:

environment, interaction, living, nonliving, organism, survive, observe, terrarium, aquarium, temperature, moisture, small–scale

Science Benchmark

Forces cause changes in the speed or direction of the motion of an object. The greater the force placed on an object, the greater the change in motion. The more massive an object is, the less effect a given force will have upon the motion of the object. Earth's gravity pulls objects toward it without touching them.

Standard III: Students will understand the relationship between the force applied to an object and resulting motion of the object.

Standard III: Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective 1: Demonstrate how forces cause changes in speed or direction of objects.

a. Show that objects at rest will not move unless a force is applied to them.

b. Compare the forces of pushing and pulling.

c. Investigate how forces applied through simple machines affect the direction and/or amount of resulting force.

Objective 2: Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object.

a. Predict and observe what happens when a force is applied to an object (e.g., wind, flowing water).

b. Compare and chart the relative effects of a force of the same strength on objects of different weight (e.g., the breeze from a fan will move a piece of paper but may not move a piece of cardboard).

c. Compare the relative effects of forces of different strengths on an object (e.g., strong wind affects an object differently than a breeze).

d. Conduct a simple investigation to show what happens when objects of various weights collide with one another (e.g., marbles, balls).

e. Show how these concepts apply to various activities (e.g., batting a ball, kicking a ball, hitting a golf ball with a golf club) in terms of force, motion, speed, direction, and distance (e.g. slow, fast, hit hard, hit soft).

Standard IV: Students will understand that objects near Earth are pulled toward Earth by gravity.

Objective 1: Demonstrate that gravity is a force.

a. Demonstrate that a force is required to overcome gravity.

b. Use measurement to demonstrate that heavier objects require more force than lighter ones to overcome gravity.

Objective 2: Describe the effects of gravity on the motion of an object.

Standard IV: Students will understand that objects near Earth are pulled toward Earth by gravity.

a. Compare how the motion of an object rolling up or down a hill changes with the incline of the hill.

b. Observe, record, and compare the effect of gravity on several objects in motion (e.g., a thrown ball and a dropped ball falling to Earth).

c. Pose questions about gravity and forces.

Science language students should use:
distance, force, gravity, weight, motion, speed, direction, simple machine

Science Benchmark

Light is produced by the sun and observed on Earth. Living organisms use heat and light from the sun. Heat is also produced from motion when one thing rubs against another. Things that give off heat often give off light. While operating, mechanical and electrical machines produce heat and/or light.

Standard V: Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Standard V: Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 1: Provide evidence showing that the sun is the source of heat and light for Earth.

a. Compare temperatures in sunny and shady places.

b. Observe and report how sunlight affects plant growth.

c. Provide examples of how sunlight affects people and animals by providing heat and light.

d. Identify and discuss as a class some misconceptions about heat sources (e.g., clothes do not produce heat, ice cubes do not give off cold).

Objective 2: Demonstrate that mechanical and electrical machines produce heat and sometimes light.

a. Identify and classify mechanical and electrical sources of heat.

b. List examples of mechanical or electrical devices that produce light.

c. Predict, measure, and graph the temperature changes produced by a variety of mechanical machines and electrical devices while they are operating.

Objective 3: Demonstrate that heat may be produced when objects are rubbed against one another.

a. Identify several examples of how rubbing one object against another produces heat.

b. Compare relative differences in the amount of heat given off or force required to move an object over lubricated/ non–lubricated surfaces and smooth/rough surfaces (e.g., waterslide with and without water, hands rubbing together with and without lotion).

Science language students should use:

mechanical, electrical, temperature, degrees, lubricated, misconception, heat source, machine

K-6 Elementary Mathematics Core Curriculum in Table Format

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard I: Students will understand simple number concepts and relationships.	Standard I: Students will acquire number sense and perform simple operations with whole numbers.	Standard I: Students will acquire number sense and perform operations with whole numbers.	Standard I: Students will acquire number sense and perform operations with whole numbers and simple fractions.	Standard I: Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.	Standard I: Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.	Standard I: Students will acquire number sense and perform operations with rational numbers.
Objective 1: Identify and use whole numbers. a. Relate a *numeral* to the number of objects in a set (e.g., □ □ □ = 3). b. Construct models of numbers to 10 with physical objects or manipulatives. c. Make pictorial representations of numbers to 10 (e.g., draw four circles, draw six squares). d. Recognize and write numerals from 0 to 10. e. Manipulate objects to demonstrate and describe multiple ways of representing a number (e.g., 5 can be 3 and 2 more, 5 can also be 2 and 2 and 1).	Objective 1: Represent whole numbers in a variety of ways. a. Relate number words to the *numerals* that represent the quantities 0 to 10. b. Sort objects into groups of tens and ones and write the numeral representing the set. c. Represent *whole numbers* up to 100 in groups of tens and ones using objects. d. Write a numeral when given the number of tens and ones. e. Write a numeral to 99 in *expanded form* (e.g., 39 is 3 tens and 9 ones or 30+9). f. Use zero to represent the number of elements in the empty set or as a placeholder in a two-digit numeral.	Objective 1: Represent whole numbers in a variety of ways. a. Relate number words to the *numerals* that represent the quantities 0-100. b. Represent *whole numbers* up to 1,000 in groups of hundreds, tens, and ones using base ten models, and write the numeral representing the set. c. Read and write a three-digit numeral, relating it to a set of objects and a pictorial representation. d. Write a numeral to 999 in *expanded form* (e.g., 539 is 5 hundreds, 3 tens, 9 ones or 500+30+9). e. Identify the place and the value of a given digit in a three-digit numeral (e.g., the two in 281 means 2 hundreds or 200). f. Demonstrate multiple ways to represent numbers using symbolic representations (e.g., thirty is the same as two groups of 15, the number of pennies in three dimes, or 58-28).	Objective 1: Represent whole numbers in a variety of ways. a. Model, read, and write *whole numbers* up to 10,000 using base ten models, pictures, and symbols. b. Write a *numeral* when given the number of thousands, hundreds, tens, and ones. c. Write a number up to 9,999 in expanded form (e.g., 6,539 is 6 thousands, 5 hundreds, 3 tens, 9 ones or 6000+500+30+9). d. Identify the place and the value of a given digit in a four-digit numeral. e. Demonstrate multiple ways to represent numbers using models and symbolic representations (e.g., fifty is the same as two groups of 25, the number of pennies in five dimes, or 75-25).	Objective 1: Represent whole numbers and decimals in a variety of ways. a. Model, read, and write numerals from tenths to 100,000. b. Write a *whole number* up to 99,999 in *expanded form* (e.g., 76,539 is 7 ten-thousands, 6 one-thousands, 5 hundreds, 3 tens, 9 ones or 70,000 + 6,000 + 500 + 30 + 9). c. Identify the place and the value of a given digit in a five-digit numeral, including decimals to tenths. d. Demonstrate multiple ways to represent numbers by using models and symbolic representations (e.g., 36 is the same as the square of six, three dozen, or 9x4). e. Identify *square numbers* using models.	Objective 1: Represent whole numbers and decimals in a variety of ways. a. Model, read, and write numerals from hundredths to one millions. b. Write a *whole number* up to 999,999 in expanded form (e.g., 876,539 = 8 hundred-thousands, 7 ten-thousands, 6 thousands, 5 hundreds, 3 tens, 9 ones or 8x100,000 + 7x10,000 + 6x1,000 + 5x100 + 3x10 + 9). c. Demonstrate multiple ways to represent whole numbers by using models and symbolic representations (e.g., 108=2x50+8; 108=10^2 + 8). d. Classify whole numbers from 2 to 20 as *prime* or *composite* and 0 and 1 as neither prime nor composite, using models. e. Represent repeated factors using *exponents* up to three (e.g., 8=2x2x2=2^3).	Objective 1: Represent whole numbers and decimals in a variety of ways. a. Change *whole numbers* with *exponents* to *standard form* (e.g., 2^4 = 2^4=16) and recognize that 10^0 = 1. b. Read and write *numerals* from thousandths to one billion. c. Write a whole number to 999,999 in *expanded form* using *exponents* (e.g., 876,539 = 8 x 10^5 + 7 x 10^4 + 6 x 10^3 + 5 x 10^2 + 3 x 10^1 + 9 x 10^0). d. Express numbers in *scientific notation* using positive powers of ten. e. Classify whole numbers to 100 as *prime, composite,* or neither. f. Determine the *prime factorization* for a whole number up to 50.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Identify simple relationships among whole numbers.** a. Develop strategies for *one-to-one* correspondence and keeping track of quantities. b. Compare two sets of objects to determine whether they have the same, fewer, or more elements. c. Order sets of objects from 1 to 9. d. Estimate quantities less than 10.	Objective 2: **Identify simple relationships among whole numbers.** a. Identify the number that is one more or one less than any *whole number* from 1 to 99. b. Use the vocabulary "greater than," "less than," and "equal to" when comparing sets of objects or numbers. c. Order sets of objects and numbers from 0 to 20. d. Use *ordinal numbers* 1st through 5th (i.e., 1st, 2nd, 3rd, 4th, 5th).	Objective 2: **Identify simple relationships among whole numbers.** a. Identify the number that is one more, one less, ten more, or ten less than any *whole number* up to 100. b. Write number sentences using the terms "greater than," "less than," or "equal to," to compare numbers. c. Order four whole numbers less than 100 from least to greatest and from greatest to least. d. Use *ordinal numbers* 1st through 10th.	Objective 2: **Identify relationships among whole numbers.** a. Use a variety of strategies to determine whether a number is even or odd. b. Identify the number that is ten more, ten less, 100 more, or 100 less than any *whole number* up to 1,000. c. Compare the relative size of numbers (e.g., 31 is large compared to 4, about half as big as 60, close to 27). d. Compare whole numbers up to four digits using the symbols <, >, and =. e. Order and compare whole numbers on a number line.	Objective 2: **Identify relationships among whole numbers and decimals.** a. Identify the number that is 100 more, 100 less, 1,000 more, or 1,000 less than any *whole number* up to 10,000. b. Compare the relative size of numbers (e.g., 100 is small compared to a million, but large compared to 5). c. Compare whole numbers up to five digits using the symbols <, >, and =. d. Identify a whole number that is between two given whole numbers. e. Order and compare whole numbers and decimals to tenths on a number line.	Objective 2: **Identify relationships among whole numbers, fractions, decimals, and percents.** a. Order and compare *whole numbers*, fractions (including mixed numbers), and decimals using a variety of methods and symbols. b. Rewrite mixed numbers and improper fractions from one form to the other. c. Find the least common denominator for two fractions. d. Represent commonly used fractions as decimals and percents in various ways (e.g., objects, pictures, calculators).	Objective 2: **Identify relationships among whole numbers, fractions (rational numbers), decimals, and percents.** a. Find the *greatest common factor* and *least common multiple* for two numbers using a variety of methods (e.g., list of multiples, prime factorization). b. Order and compare *rational numbers*, including mixed numbers, using a variety of methods and symbols. c. Locate positive rational numbers on a number line. d. Convert common fractions, decimals, and percents from one form to another (e.g., 3/4= 0.75 = 75%).

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 3: **Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.** a. Demonstrate the joining and separating of sets of objects to solve problems. b. Describe the joining or separating of sets with informal language when using models. c. Record pictorially the results from the joining or separating of sets.	Objective 3: **Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.** a. Demonstrate the joining and separating of sets with twelve or fewer objects and record the results with pictures or symbols. b. Model two meanings of subtraction: separating of sets ("take away") and comparison of sets ("how many more/fewer") using objects, pictorial representations, and symbols. c. Use correct vocabulary and symbols to describe addition (i.e., add, "and," plus, +, sum), subtraction (i.e., subtract, minus, -, take away, how many more/fewer), and equals (i.e., =, same as). d. Use zero in addition and subtraction sentences.	Objective 3: **Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.** a. Demonstrate the joining and separating of sets with eighteen or fewer objects and record the results with pictures or symbols. b. Model three meanings of subtraction: separating of sets ("take away"), comparison of sets ("how many more/fewer"), and missing addends using objects, pictorial representations, and symbols. c. Separate a given set of objects into two, three, five, or ten groups of equal size. d. Model addition and subtraction of two-digit whole numbers in a variety of ways. e. Select an addition or subtraction sentence to solve a problem involving joining or separating of sets with eighteen or fewer objects. f. Recognize that addition number sentences have related subtraction sentences (e.g., 8-5=3, 3+5=8).	Objective 3: **Model and illustrate meanings of the operations of addition, subtraction, multiplication, and division and describe how they relate.** a. Model addition and subtraction of two- and three-digit *whole numbers* in a variety of ways. b. Model multiplication of a one-digit *factor* by a one-digit factor using various methods (e.g., repeated addition, rectangular *arrays,* manipulatives, pictures) and connect the representation to an *algorithm*. c. Model division as sharing equally and as repeated subtraction using various methods (e.g., rectangular arrays, manipulatives, number lines, pictorial representations). d. Demonstrate, using objects, that multiplication and division are inverse operations (e.g., 3x4=12; thus, 12÷4=3 and 12÷3=4). e. Select and write an addition, subtraction, or multiplication sentence to solve a problem related to the students' environment, and write a story problem that relates to a given equation. f. Demonstrate the effects of place value when multiplying whole numbers by 10.	Objective 3: **Model and illustrate meanings of the four operations and describe how they relate.** a. Use models to represent multiplication of a one- or two-digit *factor* by a two-digit factor (up to 30) using a variety of methods (e.g., rectangular *arrays*, manipulatives, pictures) and connect the representation to an *algorithm*. b. Recognize that division by zero is not possible (e.g., 6÷0 is undefined). c. Select and write a multiplication or division sentence to solve a problem related to the students' environment and write a story problem that relates to a given equation. d. Represent division of a two-digit *dividend* by a one-digit *divisor*, including whole number remainders, using various methods (e.g., rectangular arrays, manipulatives, pictures) and connect the representation to an algorithm. e. Demonstrate that multiplication and division are inverse operations (e.g., 3x4=12; thus, 12÷4=3 and 12÷3=4). f. Describe the effect of place value when multiplying whole numbers by 10 and 100.	Objective 3: **Model and illustrate meanings of operations and describe how they relate.** a. Identify the *dividend*, *divisor,* and *quotient* regardless of the division symbol used. b. Determine whether a whole number is divisible by 2, 3, 5, 9, and/or 10, using the r*ules of divisibility*. c. Represent remainders as *whole numbers,* decimals, or fractions and describe the meaning of remainders as they apply to problems from the students' environment (e.g., If there are 53 people, how many vans are needed if each van holds 8 people?). d. Model addition, subtraction, and multiplication of fractions and decimals in a variety of ways (e.g., using objects and a number line). e Select or write the number sentences that can be used to solve a two-step problem. f. Model different strategies for whole number multiplication (e.g., partial product, lattice) and division (e.g., partial quotient). g. Describe the effect on place value when multiplying and dividing whole numbers and decimals by 10, 100, and 1,000.	Objective 3: **Model and illustrate meanings of operations and describe how they relate.** a. Represent division of a multi-digit *dividend* by two-digit *divisors,* including decimals, using models, pictures, and symbols. b. Model addition, subtraction, multiplication, and division of fractions and decimals in a variety of ways (e.g., objects, a number line). c. Apply r*ules of divisibility*. d. Select or write a number sentence that can be used to solve a multi-step problem and write a word problem when given a two-step expression or equation.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
	Objective 4: **Use fractions to identify parts of the whole.** a. Share sets of up to ten objects between two students and identify each part as half. b. Divide geometric shapes into equal parts, identifying halves and fourths.	Objective 4: **Use fractions to identify parts of the whole.** a. Separate geometric shapes and sets of objects into halves, thirds, and fourths using a variety of models and illustrations. b. Specify a region of a geometric shape (e.g., as "___ out of ___ equal parts" when given four or fewer equal parts. c. Represent the unit fractions 1/2, 1/3, and 1/4 with objects, pictures, and symbols.	Objective 4: **Use fractions to communicate parts of the whole.** a. Identify the denominator of a fraction as the number of equal parts in the whole region or set. b. Identify the numerator of a fraction as the number of equal parts being considered. c. Divide *regions* and sets of objects into equal parts using a variety of models and illustrations. d. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, sixths, and eighths. e. Determine which of two fractions is greater using models or illustrations.	Objective 4: **Use fractions to communicate parts of the whole.** a. Divide regions and sets of objects into equal parts using a variety of models and illustrations. b. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, fifths, sixths, eighths, and tenths. c. Relate fractions to decimals that represent tenths. d. Determine which of two fractions is greater using models or illustrations. e. Find equivalent fractions for one-half, one-third, and one-fourth using manipulatives and pictorial representations.	Objective 4: **Use fractions to communicate parts of the whole.** a. Divide regions, sets of objects, and line segments into equal parts using a variety of models and illustrations. b. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths. c. Represent the simplest form of a fraction in various ways (e.g., objects, pictorial representations, symbols). d. Represent mixed numbers and improper fractions in various ways (e.g., rulers, objects, number lines, symbols). e. Rename *whole numbers* as fractions with different denominators (e.g., 5=5/1, 3=6/2, 1=7/7). f. Model and calculate equivalent forms of a fraction and describe the process used.	Objective 4: **Use fractions and percents to communicate parts of the whole.** a. Divide regions, sets of objects, and *line segments* into equal parts using a variety of models and illustrations. b. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, fifths, sixths, eighths, tenths, twelfths, and sixteenths. c. Write a fraction or ratio in simplest form. d. Name equivalent forms for fractions (halves, thirds, fourths, fifths, tenths), ratios, percents, and decimals, including repeating or terminating decimals. e. Relate percents less than 1% or greater than 100% to equivalent fractions, decimals, *whole numbers*, and mixed numbers.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
	Objective 5: **Solve whole number problems using addition and subtraction in horizontal and vertical notation.** a. Compute addition and subtraction facts to twelve. b. Add three whole numbers with sums to twelve.	Objective 5: **Solve whole number problems using addition and subtraction in vertical and horizontal notation.** a. Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator). b. Compute accurately with basic number combinations for addition and subtraction facts to eighteen. c. Add three *whole numbers* with sums to eighteen. d. Find the sum of two-digit whole numbers and describe the process used.	Objective 5: **Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.** a. Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator). b. Find the sum of any two *addends* with three or fewer digits, including monetary amounts, and describe the process used. c. Find the *difference* of two-digit *whole numbers* and describe the process used. d. Find the *product* for multiplication facts through ten times ten and describe the process used.	Objective 5: **Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.** a. Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator. b. Find the sum and difference of four-digit numbers, including monetary amounts, and describe the process used. c. Multiply two- and three-digit *factors* by a one-digit factor and describe the process used. d. Divide a two-digit *whole number dividend* by a one-digit *divisor*, with a *remainder* of zero and describe the process used.	Objective 5: **Solve problems using the four operations with whole numbers, decimals, and fractions.** a. Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator. b. Use estimation strategies to determine whether results obtained using a calculator are reasonable. c. Multiply up to a three-digit whole number by a one- or two-digit whole number. d. Divide up to a three-digit *whole number dividend* by a one-digit *divisor*. e. Add and subtract decimals with digits to the hundredths place (e.g., 35.42+7.2; 75.2–13.45). f. Add, subtract, and multiply fractions. g. Simplify *expressions,* without *exponents,* using the *order of operations.*	Objective 5: **Solve problems using the four operations with whole numbers, decimals, and fractions.** a. Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator. b. Use estimation strategies to determine whether results obtained using a calculator are reasonable. c. Multiply up to a three-digit *factor* by a one- or two-digit factor including decimals. d. Divide up to a three-digit *dividend* by a one- or two-digit *divisor* including decimals. e. Add and subtract decimals to the thousandths place (e.g., 34.567+3.45; 65.3-5.987). f. Add, subtract, multiply, and divide fractions and mixed numbers. g. Solve problems using ratios and proportions. h. Simplify *expressions,* with *exponents*, using the *order of operations.*

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
					Objective 6: **Model and illustrate integers.** a. Identify, read, and locate *integers* on a number line. b. Describe situations where integers are used in the students' environment.	Objective 6: **Model, illustrate, and perform the operations of addition and subtraction of integers.** a. Recognize that the sum of an *integer* and its opposite is zero. b. Model addition and subtraction of integers using manipulatives and a number line. c. Add and subtract integers.
Standard II: **Students will identify and use patterns to represent mathematical situations.**	Standard II: **Students will identify and use patterns and relations to represent mathematical situations.**	Standard II: **Students will identify and use patterns and relations to represent mathematical situations.**	Standard II: **Students will use patterns and relations to represent mathematical situations.**	Standard II: **Students will use patterns and relations to represent mathematical situations.**	Standard II: **Students will use patterns and relations to represent and analyze mathematical situations using algebraic symbols.**	Standard II: **Students will use patterns, relations, and functions to represent and analyze mathematical situations using algebraic symbols.**
Objective 1: **Identify and sort objects according to common attributes.** a. Sort objects into groups by color, shape, size, number, or other *attributes.* b. Identify which attribute was used to sort objects into a group. c. Find multiple ways to sort and classify a group of objects.	Objective 1: **Recognize and represent patterns with one or two attributes.** a. Sort and classify objects by one or two *attributes.* b. Identify, create, and label simple patterns using manipulatives, pictures, and symbolic notation (e.g., ABAB. . ., □ ○ △ □ ○ △ . . .). c. Identify patterns in the environment. d. Identify horizontal and vertical patterns on hundreds charts. e. Use patterns to establish skip counting by twos to 20 and by fives and tens to 100. f. Count backward from 10 to 0 and identify the pattern.	Objective 1: **Recognize and represent patterns having multiple attributes.** a. Sort, classify, and label objects by three or more *attributes.* b. Identify and label repeating and growing patterns using objects, pictures, and symbolic notation (e.g., ABAABBAAABBB...). c. Identify repeating and growing patterns in the environment. d. Construct models and skip count by twos, threes, fives, and tens and relate to repeated addition.	Objective 1: **Recognize and create patterns with given attributes.** a. Create and extend *repeating* and *growing* patterns using objects, numbers, and tables. b. Record results of patterns created using manipulatives, pictures, and numeric representations and describe how they are extended.	Objective 1: **Recognize, describe, and use patterns and identify the attributes.** a. Represent and analyze repeating and growing patterns using objects, pictures, numbers, and tables. b. Recognize and extend multiples and other number patterns using a variety of methods.	Objective 1: **Recognize, analyze, and use patterns and describe their attributes.** a. Analyze and make predictions about patterns involving *whole numbers,* decimals, and fractions using a variety of tools including organized lists, tables, objects, and variables. b. Extend patterns and describe a rule for predicting the next element.	Objective 1: **Recognize, analyze, and use multiple representations of patterns and functions and describe their attributes.** a. Analyze patterns on graphs and tables and write a generalization to predict how the patterns will continue. b. Create tables and graphs to represent given patterns and algebraic *expressions.* c. Draw a graph from a table of values or to represent an equation. d. Write an algebraic expression from a graph or a table of values.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Identify and use patterns to describe numbers or objects.** a. Use patterns to count orally from 1 to 20 and backward from 10 to 0. b. Identify simple patterns in the environment. c. Predict what comes next in an established pattern and justify thinking. d. Duplicate, extend, and create simple patterns using objects and pictorial representations.	Objective 2: **Recognize and represent relations using mathematical symbols.** a. Recognize that "=" indicates a relationship in which the quantities on each side of an equation are equal. b. Recognize that symbols such as ☐, △, or ◇ in an addition or subtraction equation represent a missing value that will make the statement true (e.g., ☐ + 3 = 6, 5 +7 = △, 4 = 5 – ◇). c. Demonstrate that changing the order of *addends* does not change the *sum* (e.g., 3+2=5 and 2+3=5).	Objective 2: **Recognize and represent relations using mathematical symbols.** a. Recognize that "≠" indicates a relationship in which the quantities on each side are not of equal value. b. Recognize that symbols such as ☐, △, or ◇ in an addition or subtraction equation represent a value that will make the statement true (e.g., ☐ +3=6, 5+7=△, 7=9-◇). c. Demonstrate that changing the order of addends does not change the sum (e.g., 3+2+7=12, 7+3+2=12) and that changing the grouping of three or more *addends* does not change the *sum* (e.g., (2+3)+7=12, 2+(3+7)=12).	Objective 2: **Recognize and represent mathematical situations using patterns and symbols.** a. Recognize that symbols such as ☐, △, or ◇ in an addition, subtraction, or multiplication equation, represent a value that will make the statement true (e.g., 5+7=△, ☐-3=6, ◇=2x4). b. Solve equations involving equivalent expressions (e.g., 6+4 = ☐+7). c. Use the >, <, and = symbols to compare two *expressions* involving addition and subtraction (e.g., 4+6 ☐ 3+2; 3+5 ◇ 16-9). d. Demonstrate that grouping three or more *addends* does not change the *sum* (e.g., 3+(2+7)=12, (7+3)+2=12) and changing the order of *factors* does not change the *product* (e.g., 3x7=21, 7x3=21). e. Use a variety of manipulatives to model the *identity property of addition* (e.g., 3+0=3), the *identity property of multiplication* (e.g., 7x1=7), and the *zero property of multiplication* (e.g., 6x0=0).	Objective 2: **Recognize, represent, and solve mathematical situations using patterns and symbols.** a. Solve equations involving equivalent expressions (e.g., 6x2= ☐x3 or 6x☐=9+9). b. Use the <, >, = symbols to compare two expressions involving addition, subtraction, multiplication, and division (e.g., 5x4◇9÷3). c. Recognize that a given variable maintains the same value throughout an equation or expression (e.g., ☐+☐=8; ☐=4). d. Demonstrate that changing the order of factors does not change the product (e.g., 2x3=6, 3x2=6) and that the grouping of three or more *factors* does not change the *product* (e.g., (2x3)x1=6; 2x(3x1)=6). e. Demonstrate the distribution of multiplication over addition using a rectangular *array* (e.g., 8x14=8 rows of 10 plus 8 rows of 4).	Objective 2: **Represent, solve, and analyze mathematical situations using algebraic symbols.** a. Recognize a variety of symbols for multiplication and division including x, •, and * as symbols for multiplication and ÷, ⌐¯¯, and a fraction bar (/ or -) as division symbols. b. Recognize that a variable (◇, n, x) represents an unknown quantity. c. Solve one-step equations involving *whole numbers* and a single variable (e.g., n÷7=3). d. Recognize that the answer to a multiplication problem involving a factor of zero is equal to zero (e.g., 0x45=0). e. Use expressions or one-step equations to represent real-world situations. f. Use the *associative, commutative,* and *distributive properties* to compute with whole numbers.	Objective 2: **Represent, solve, and analyze mathematical situations using algebraic symbols.** a. Recognize that a number in front of a variable indicates multiplication (e.g., 3*y* means 3 times the quantity y). b. Solve two-step equations involving *whole numbers* and a single variable (e.g., 3x+4=19). c. Recognize that "≈" indicates a relationship in which the quantities on each side are approximately of equal value (e.g., π ≈3.14). d. Recognize that an *exponent* can be represented in the following ways: 4^3 or 4^3. e. Evaluate *expressions* and formulas, substituting given values for the variables (e.g., 2x+4; x=2; therefore, 2(2)+4=8). f. Recognize that if the *product* is zero, then one or more *factors* equal zero (i.e., if ab=0 then either a=0 or b=0 or a and b=0).

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard III: Students will identify and create simple geometric shapes and describe spatial relationships.	Standard III: Students will describe, identify, and create and simple geometric shapes and describe spatial relationships.	Standard III: Students will describe, identify, and create geometric shapes and describe spatial relationships.	Standard III: Students will use spatial reasoning to describe, identify, and create geometric shapes.	Standard III: Students will use spatial reasoning to recognize, describe, and identify geometric shapes.	Standard III: Students will use spatial reasoning to recognize, describe, and identify geometric shapes and principles.	Standard III: Students will use spatial and logical reasoning to recognize, describe, and identify geometric shapes and principles.
Objective 1: **Identify and create simple geometric shapes.** a. Identify circles, triangles, rectangles, and squares. b. Combine shapes to create *two-dimensional* objects. c. Draw circles, triangles, rectangles, and squares. d. Recognize circles, triangles, rectangles, and squares in the students' environment.	Objective 1: **Describe, identify, and create simple geometric shapes.** a. Identify, name, draw, create, and sort circles, triangles, rectangles, and squares. b. Identify circles, triangles, rectangles, and squares in the students' environment. c. Recognize that combining simple geometric shapes can create more complex geometric shapes.	Objective 1: **Describe, identify, and create geometric shapes.** a. Identify, name, draw, sort, and compare circles, triangles, and *parallelograms*. b. Identify and name spheres, cones, and cylinders. c. Find and identify familiar geometric shapes in the students' environment. d. Determine whether a circle, triangle, square, or rectangle has a *line of symmetry*.	Objective 1: **Describe, identify, and create geometric shapes.** a. Identify and draw *points, lines, line segments,* and *endpoints*. b. Identify and draw *lines of symmetry* on triangles, squares, circles, and rectangles. c. Determine whether an angle is *right, obtuse,* or *acute* by comparing the angle to the corner of a rectangle. d. Classify polygons (e.g., *quadrilaterals,* pentagons, hexagons, octagons) by the number of sides and corners. e. Identify, make, and describe cubes (e.g., a cube has 6 square *faces,* 8 *vertices*, and 12 *edges*).	Objective 1: **Describe, identify, and analyze characteristics and properties of geometric shapes.** a. Identify and draw *parallel lines* and *intersecting lines*. b. Identify and draw lines of symmetry on a variety of polygons. c. Identify and describe quadrilaterals (i.e., rectangles, squares, rhombuses, trapezoids, kites). d. Identify right, obtuse, and acute angles. e. Compare two polygons to determine whether they are congruent or similar. f. Identify and describe cylinders and rectangular prisms.	Objective 1: **Describe, identify, and analyze characteristics and properties of geometric shapes.** a. Identify and draw *perpendicular* lines. b. Draw, label, and describe rays and describe an angle as two rays sharing a common endpoint. c. Label an angle as *acute, obtuse, right,* or *straight*. d. Identify and describe *equilateral, isosceles, scalene, right, acute,* and *obtuse* triangles. e. Identify the *vertex* of an angle or the *vertices* of a polygon. f. Compare *corresponding angles* of two triangles and determine whether the triangles are *similar*. g. Identify and describe *pyramids* and *prisms*.	Objective 1: **Identify and analyze characteristics and properties of geometric shapes.** a. Identify the *midpoint* of a *line segment*. b. Identify concave and *convex polygons*. c. Identify the center, *radius, diameter*, and *circumference* of a circle. d. Identify the number of *faces, edges,* and vertices of *pyramids* and *prisms*.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Describe simple spatial relationships.** a. Visualize how to fit a shape into a design. b. Use and demonstrate words to describe position with objects (i.e., on, over, under, above, below, top, bottom, up, down, in front of, behind, next to, beside). c. Use and demonstrate words to describe distance with objects (i.e., far, near).	Objective 2: **Describe simple spatial relationships.** a. Use and demonstrate words to describe position (i.e., between, before, after, middle, left, right). b. Use and demonstrate words to describe distance (i.e., closer, farther).	Objective 2: **Describe spatial relationships.** a. Create and use verbal or written instructions to move within the environment. b. Find and name locations using coordinates (A, 1). c. Identify shapes in various orientations (e.g., △ and ▽).	Objective 2: **Describe spatial relationships.** a. Give directions to reach a location. b. Use coordinates (A, 1) or regions to locate positions on a map. c. Demonstrate and use horizontal and vertical lines.	Objective 2: **Specify locations and describe spatial relationships using grids and maps.** a. Locate positions on a map of Utah using coordinates or regions. b. Give the *coordinates* or *regions* of a position on a map of Utah.	Objective 2: **Specify locations and describe spatial relationships using coordinate geometry.** a. Locate points defined by ordered pairs in the first quadrant. b. Write an ordered pair for a point in the first *quadrant*. c. Specify possible paths between locations on a *coordinate grid* and compare distances of the various paths.	Objective 2: **Specify locations and describe spatial relationships using coordinate geometry.** a. Graph points defined by ordered pairs in all four quadrants. b. Write the ordered pair for a point in any quadrant.
			Objective 3: **Visualize and identify geometric shapes after applying transformations.** a. Demonstrate the effect of a slide (translation) or flip (reflection) on a figure, using manipulatives. b. Determine whether two polygons are *congruent* by sliding, flipping, or turning to physically fit one object on top of the other. c. Identify *two-dimensional* shapes (*nets*) that will fold to make a cube. d. Create a *polygon* that results from combining other polygons.	Objective 3: **Visualize and identify geometric shapes after applying transformations.** a. Identify a *slide (translation)* or *flip (reflection)* on a figure using manipulatives. b. Relate *cubes, cylinders, cones,* and rectangular prisms to the *two-dimensional* shapes (*nets*) from which they were created.	Objective 3: **Visualize and identify geometric shapes after applying transformations.** a. Identify a *slide (translation)* or *flip (reflection)* on a figure across a line. b. Demonstrate the effect of a *turn (rotation)* on a figure using manipulatives. c. Relate pyramids and prisms to the *two-dimensional* shapes (*nets*) from which they were created.	Objective 3: **Visualize and identify geometric shapes after applying transformations.** a. *Turn (rotate)* a shape around a point and identify the location of the new vertices. b. *Slide (translate)* a polygon either horizontally or vertically on a coordinate grid and identify the location of the new vertices. c. *Flip (reflect)* a shape across either the x- or y-axis and identify the location of the new vertices.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard IV: **Students will understand and use simple measurement tools and techniques.**	Standard IV: **Students will understand and use simple measurement tools and techniques.**	Standard IV: **Students will understand and use measurement tools and techniques.**	Standard IV: **Students will understand and use measurement tools and techniques.**	Standard IV: **Students will understand and use measurement tools and techniques.**	Standard IV: **Students will understand and apply measurement tools and techniques.**	Standard IV: **Students will understand and apply measurement tools and techniques.**
Objective 1: **Identify measurable attributes of objects and units of measurement.** a. Identify clocks and calendars as tools that measure time. b. Identify a day, week, and month on a calendar. c. Identify pennies, nickels, dimes, and quarters as units of money.	Objective 1: **Identify measurable attributes of objects and units of measurement.** a. Identify the appropriate tools for measuring length, weight, capacity, temperature, and time. b. Identify the values of a penny, nickel, dime, and quarter. c. Estimate the length of an object by comparing to a nonstandard unit (e.g., How many new pencils wide is your desk?).	Objective 1: **Identify measurable attributes of objects and units of measurement.** a. Sequence a series of events of a day in order by time (e.g., breakfast at 7:00, school begins at 9:00). b. Identify the name and value of a penny, nickel, dime, quarter, and dollar. c. Estimate length, capacity, and weight using customary units.	Objective 1: **Identify and describe measurable attributes of objects and units of measurement.** a. Recognize the two systems of measurement: *metric* and *customary*. b. Describe the relationship between metric units of length (i.e., centimeter, meter). c. Describe the relationship among customary units of length (i.e., inch, foot, yard) and the relationship between customary units of *capacity* (i.e., cup, quart). d. Estimate length, capacity, and weight using metric and customary units.	Objective 1: **Identify and describe measurable attributes of objects and units of measurement.** a. Describe the relationship among metric units of length (i.e., millimeter, centimeter, meter), between *metric* units of capacity (i.e., milliliter, liter), and between metric units of weight (i.e., gram, kilogram). b. Identify a mile as a measure of distance and its relationship to other *customary* units of length. c. Describe the relationship among customary units of *capacity* (i.e., cup, pint, quart, gallon). d. Estimate length, capacity, and weight using metric and customary units.	Objective 1: **Identify and describe measurable attributes of objects and units of measurement.** a. Describe the relationship among *metric* units of length (i.e., millimeter, centimeter, meter, kilometer). b. Describe the relationship among *customary* units of weight (i.e., ounce, pound). c. Identify the correct units of measurement for *volume, area,* and *perimeter* in both metric and customary systems. d. Estimate length, volume, weight, and area using metric and customary units. e. Convert units of measurement within the metric system and convert units of measurement within the customary system.	Objective 1: **Identify and describe measurable attributes of objects and units of measurement.** a. Compare a meter to a yard, a liter to a quart, and a kilometer to a mile. b. Identify π as the ratio of the *circumference* to *diameter* of a circle. c. Explain how the size of the unit used in measuring affects the precision. d. Estimate length, volume, weight, and area using *metric* and customary units.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Use appropriate techniques and tools to determine measurements.** a. Compare two objects (e.g., shorter/longer, heavier/lighter, larger/smaller, more/less). b. Find the length of an object using nonstandard units (e.g., pencils, paper clips). c. Name the days of the week in order. d. Sort pennies, nickels, dimes, and quarters.	Objective 2: **Use appropriate techniques and tools to determine measurements.** a. Compare objects, using nonstandard units, according to their length, weight, or volume (e.g., pencils/length, books/weight, boxes/volume). b. Read and tell time to the nearest hour. c. Name the days of the week, months of the year, and seasons in order. d. Determine the value of a set of the same coins that total 25¢ or less (e.g., a set of 14 pennies equals 14¢, a set of 5 nickels equals 25¢, a set of 2 dimes equals 20¢).	Objective 2: **Use appropriate techniques and tools to determine measurements.** a. Compare and order objects, using nonstandard units, according to their length, weight, or capacity. b. Measure length using inches and feet, weight using pounds, and *capacity* using cups. c. Determine the value of a set of up to five coins that total $1.00 or less (e.g., two quarters and one dime equals 60¢; three dimes, one nickel, and one penny equals 36¢). d. Read, tell, and write time to the hour and half-hour. e. Use a calendar to determine the day of the week and date. f. Determine the *perimeter* of a square, triangle, and rectangle by measuring with nonstandard units.	Objective 2: **Use appropriate techniques and tools to determine measurements.** a. Measure the length of objects to the nearest centimeter, meter, half-inch, foot, and yard. b. Measure *capacity* using cups and quarts, and measure weight using pounds. c. Determine the value of a combination of coins and bills that total $5.00 or less and write the monetary amounts using the dollar sign and decimal notation. d. Identify the number of hours in a day, the number of days in a year, and the number of weeks in a year. e. Read, tell, and write time to the quarter-hour. f. Identify any given day of the month (e.g., the third Wednesday of the month is the 18th). g. Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer. h. Estimate and measure the *perimeter* and area of rectangles by measuring with nonstandard units.	Objective 2: **Determine measurements using appropriate tools and formulas.** a. Measure the length of objects to the nearest centimeter, meter, quarter-inch, foot, and yard. b. Measure *capacity* using milliliters, liters, cups, pints, quarts, and gallons and measure weight using grams, kilograms, and pounds. c. Read, tell, and write time to the nearest minute, identifying a.m. and p.m. d. Read and record the temperature to the nearest degree, in Fahrenheit, using a thermometer. e. Determine the value of a combination of coins and bills that total $20.00 or less. f. Count back change for a single-item purchase and determine the amount of change to be received from a multiple-item purchase. g. Determine possible *perimeters,* in whole units, for a rectangle with a fixed *area* and determine possible areas when given a rectangle with a fixed perimeter.	Objective 2: **Determine measurements using appropriate tools and formulas.** a. Measure length to the nearest 1/8 of an inch and to the nearest centimeter. b. Measure *volume* and *weight* using *metric* and *customary* units. c. Measure angles using a protractor. d. Calculate *elapsed time* within a.m. or p.m. time periods. e. Read and record the temperature to the nearest degree (above and below zero) when using a thermometer with a Celsius or Fahrenheit scale. f. Calculate the *perimeter* of rectangles and triangles. g. Calculate the *area* of squares and rectangles using a formula.	Objective 2: **Determine measurements using appropriate tools and formulas.** a. Measure length to the nearest one-sixteenth of an inch and to the nearest millimeter. b. Estimate and measure an angle to the nearest degree. c. Calculate the *circumference* of a circle using a given formula. d. Calculate *elapsed time* across a.m. and p.m. time periods. e. Calculate the *areas* of triangles, rectangles, and *parallelograms* using given formulas. f. Calculate the *surface area* and *volume* of right, rectangular prisms using given formulas.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard V: **Students will collect and draw conclusions from data and understand basic concepts of probability.**	Standard V: **Students will collect and draw conclusions from data and understand basic concepts of probability.**	Standard V: **Students will collect and draw conclusions from data and understand basic concepts of probability.**	Standard V: **Students will collect and organize data to make predictions and identify basic concepts of probability.**	Standard V: **Students will collect and organize data to make predictions and use basic concepts of probability.**	Standard V: **Students will collect, analyze, and draw conclusions from data and apply basic concepts of probability.**	Standard V: **Students will collect, analyze, and draw conclusions from data and apply basic concepts of probability.**
Objective 1: **Collect, organize, and display simple data.** a. Collect, organize, and record data using objects and pictures. b. Represent data in a variety of ways (e.g., graphs made from people, *pictographs*, bar graphs) and interpret the data (e.g., more people like red than blue).	Objective 1: **Collect, organize, and display simple data.** a. Collect physical objects to use as data. b. Collect, represent, and interpret data using tables, tally marks, *pictographs*, and bar graphs.	Objective 1: **Collect, organize, and display simple data.** a. Gather data by vote or survey. b. Sort, classify, and organize data in a variety of ways. c. Use a variety of methods to organize, display, and label information, including keys, using *pictographs*, tallies, bar graphs, and organized tables. d. Report information from a data display.	Objective 1: **Collect, organize, and display data to make predictions.** a. Collect, read, represent, and interpret data using tables, graphs, and charts, including keys (e.g., pictographs, bar graphs). b. Make predictions based on a data display.	Objective 1: **Collect, organize, and display data to make predictions and answer questions.** a. Identify a question that can be answered by collecting data. b. Collect, read, and interpret data from tables, graphs, charts, surveys, and observations. c. Represent data using tables, line plots, line graphs, and bar graphs. d. Identify and distinguish between *clusters* and *outliers* of a data set.	Objective 1: **Formulate and answer questions using statistical methods to compare data.** a. Formulate a question that can be answered by collecting data. b. Collect, compare, and display data using an appropriate format (i.e., *line plots*, bar graphs, pictographs, circle graphs, line graphs). c. Identify minimum and *maximum* values for a set of data. d. Identify or calculate the *mean, mode*, and *range*. e. Propose and justify inferences based on data.	Objective 1: **Design investigations to reach conclusions using statistical methods to make inferences based on data.** a. Design investigations to answer questions by collecting and organizing data in a variety of ways (e.g., bar graphs, line graphs, frequency tables, stem and leaf plots). b. Collect, compare, and display data using an appropriate format (i.e., bar graphs, line graphs, *line plots*, circle graphs, scatter plots). c. Compare two similar sets of data on the same graph and compare two graphs representing the same set of data. d. Recognize that changing the scale influences the appearance of a display of data. e. Develop and evaluate inferences and predictions based on data.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Determine the likelihood of events.** a. Describe events encountered in books read as possible or not possible. b. Describe events as likely or unlikely (e.g., It is likely to snow today. It is unlikely an elephant will be in school).	Objective 2: **Determine the likelihood of an event.** a. Compare events to decide which are more likely, less likely, and equally likely. b. Relate past events to future events (e.g., The sun set about 6:00 last night, so it will set about the same time tonight).	Objective 2: **Determine the likelihood of an event.** a. Predict events that will be the same in one day or one week. b. Predict the outcome when there are only two possible outcomes (e.g., tossing a coin).	Objective 2: **Identify basic concepts of probability.** a. Describe the results of events using the terms "certain," "equally likely," and "impossible." b. Predict outcomes of simple activities (e.g., a bag contains three red marbles and five blue marbles. If one marble is selected, is it more likely to be red or blue?).	Objective 2: **Use basic concepts of probability.** a. Describe the results of investigations involving random outcomes as simple ratios (e.g., 4 out of 9, 4/9). b. Predict outcomes of simple experiments, including with and without replacement, and test the predictions.	Objective 2: **Apply basic concepts of probability.** a. Describe the results of investigations involving random outcomes using a variety of notations (e.g., 4 out of 9, 4/9, 4:9). b. Recognize that outcomes of experiments and samples are fractions between 0 and 1. c. Predict the probability of an outcome in a simple experiment.	Objective 2: **Apply basic concepts of probability.** a. Write the results of a probability experiment as a fraction, ratio, or percent between zero and one. b. Compare experimental results with anticipated results (e.g., experimental: 7 out of 10 tails; whereas, anticipated 5 out of 10 tails). c. Compare individual, small group, and large group results for a probability experiment.

Mathematics Glossary

acute angle	An angle with a measure less than 90º.
addend	Any number being added. In 32+4=36, 32 and 4 are addends.
algorithm	A step-by-step method for computing.
area	The measure, in square units, of the inside of a plane figure.
array	An arrangement of objects in equal rows.
Associative Property	Changing the grouping of three or more addends does not change the sum. Changing the grouping of three or more factors does not change the product.
attribute	A characteristic of an object, such as color, shape, size, etc.
capacity	The maximum amount that can be contained by an object. Often refers to measurement of a liquid.
chord	Any line segment that joins two points on a circle.
circumference	The perimeter of a circle.
cluster	Data that are grouped together.
Commutative Property	Changing the order of the addends does not change the sum. Changing the order of the factors does not change the product.
composite number	A number greater than 0 that has more than two different factors. The number 9 is a composite number because it has three factors: 1, 3, and 9.
concave polygon	A polygon with one or more diagonals that have points outside the polygon.
cone	A solid bounded by a circular base and a curved surface with one vertex.
congruent	Having exactly the same size and shape.
convex polygon	A polygon with all interior angles measuring less than 180º. All diagonals of a convex polygon are inside the figure.

coordinate grid	A two-dimensional system in which the coordinates of a point are its distances from two intersecting, usually perpendicular, straight lines called axes.
coordinates	An ordered pair of numbers that identify a point on a coordinate plane or grid.
corresponding angles	Angles in the same position from one line to another.
cube (solid figure)	A regular solid with six congruent square faces.
customary system	A system of measurement used in the U.S. The system includes units for measuring length, capacity, and weight.
cylinder	A three-dimensional figure with two circular bases that are parallel and congruent.
diameter	A chord that goes through the center of a circle.
difference	The amount that remains after one quantity is subtracted from another.
Distributive Property	When one of the factors of a product is a sum, multiplying each addend before adding does not change the product. For example: 6x(2+3)=(6x2)+(6x3)
dividend	A number that is divided by another number.
divisor	The number by which another number is divided.
e.g.	This abbreviation means “for example.” When used in the Core, e.g. is not limited to the examples given.
edge	The line segment where two faces of a solid figure meet.
elapsed time	The amount of time that passes between two times.
endpoint	A point at either end of a line segment, arc, or a point at one end of a ray.
equilateral triangle	A triangle with all sides the same length.
expanded form	A way to write numbers that shows the place value of each digit. 263 = 200 + 60 + 3 or 263 is 2 hundreds, 60 tens, and 3 ones.
exponent	The number that tells how many equal factors there are.

expression	A variable or combination of variables, numbers, and operation symbols that represents a mathematical relationship. 6, 2 + 3, x, x + 4, and x + 2y are all expressions.
face	A plane figure that serves as one side of a solid figure. The faces of a cube are squares.
factors	The whole numbers that are multiplied to get a product. In 6x3=18, 6 and 3 are factors of 18.
flip	A transformation creating a mirror image of a figure on the opposite side of a line. A flip is also called a reflection.
greatest common factor	The greatest number that is a factor of every number in a set of numbers. 3 is the greatest common factor of 9 and 15.
growing pattern	A pattern that grows or increases.
horizontal line	A line that is parallel to the horizon. A horizontal line is straight across.
i.e.	This abbreviation means "that is to say." When used in the Core, i.e. is limited to the specific examples given.
Identity Property of Addition	If you add zero to a number, the sum is the same as that number. For example, 8+0=8.
Identity Property of Multiplication	If you multiply a number by one, the product is the same as that number. For example, 18x1=18.
integers	Whole numbers and their opposites.
intersect	To meet or cross.
isosceles triangle	A triangle that has exactly two congruent sides.
least common multiple	The least common multiple of a set of two or more numbers. For example, the least common multiple of 3 and 5 is 15.
line	A set of connected points continuing without end in both directions.
line of symmetry	A line that divides a figure into two congruent halves that are mirror images of each other.
line plot	A graph showing frequency of data on a number line.

line segment	A part of a line with two endpoints.
mean	A number found by dividing the sum of two or more numbers by the number of addends. The mean is often referred to as the average.
metric system	A system of measurement based on tens. The basic unit of length is the meter. The basic unit of mass is the gram. The basic unit of capacity is the liter.
midpoint	The point on a line segment that divides it into two congruent segments.
mode	The number that appears most frequently in a set of numbers. There may be one, more than one, or no mode.
net	A two-dimensional shape that can be folded into a three-dimensional figure is a net of that figure.
numeral	A symbol used to represent a number.
obtuse angle	An angle with a measure greater than 90º and less than 180º.
obtuse triangle	A triangle with one obtuse angle.
one-to-one correspondence	The relationship between the spoken word and the written symbol.
Order of Operations	A set of rules that tells the order in which to compute.
ordinal number	A whole number that names the position of an object in sequence. First, second, and third are ordinal numbers.
outlier	A number in a set of data that is much larger or smaller than most of the other numbers in the set.
parallel lines	Lines in the same plane that are always the same distance apart.
parallelogram	A quadrilateral with two pairs of parallel and congruent sides.
perimeter	The distance around a figure.
perpendicular	Forming right angles.

pi	The ratio of the circumference of any circle to its diameter, approximately equal to 3.14.
pictograph	A graph that uses pictures to show data.
plane	A flat surface that extends infinitely in all directions.
point	An exact location in space represented by a dot.
polygon	A closed plane figure made by line segments.
prime factorization	A way to show a number as the product of prime factors. The prime factorization of 12 is 2x2x3.
prime number	A whole number greater than 0 that has exactly two different factors, 1 and itself. 5 is a prime number because its only factors are 1 and 5.
prism	A three-dimensional figure that has two congruent and parallel faces that are polygons. The rest of the faces are parallelograms.
product	The answer to a multiplication problem. For example, 6x3=18, 18 is the product of 6x3.
pyramid	A polyhedron whose base is a polygon and whose other faces are triangles that share a common vertex.
quadrants	The four sections of a coordinate grid that are separated by the axes.
Quadrilateral	A four-sided polygon.
quotient	The answer to a division problem.
radius	The segment, or the length of the segment, from the center of a circle to any point on the circle.
Range	The difference between the greatest number and the least number in a set of numbers.
rational number	A number that can be expressed as a ratio of two non-zero integers.
ray	A part of a line that has one endpoint and goes on forever in one direction.
rectangular prism	A prism with six rectangular faces.
reflection	A transformation creating a mirror image of a figure on the opposite side of a line. A reflection is also called a flip.
region	A part of a plane.

remainder	In whole number division, when you have divided as far as you can without using decimals, what has not been divided yet is the remainder.
repeating pattern	A pattern of a group of items that repeats over and over.
rhombus	A parallelogram with all four sides equal in length.
right angle	An angle that measures exactly 90º.
right triangle	A triangle that has one 90º angle.
rotation	The transformation that occurs when a figure is turned a certain angle and direction around a point. A rotation is also called a turn.
Rules of Divisibility	Patterns that make it easier to tell whether one number is divisible by another.
scalene triangle	A triangle that has no congruent sides.
scientific notation	A form of writing numbers as the product of a power of 10 and a decimal number greater than or equal to 1 and less than 10.
similar figures	Figures that have the same shape, but not necessarily the same size.
slide	A transformation that slides a figure a given distance in a given direction. A slide is also called a translation.
square number	A number that is the result of multiplying an integer by itself. Any square number of dots can be arranged in a square array.
standard form	A number written with one digit for each place value. The standard form for the number three thousand three is 3,003.
straight angle	An angle with a measure of 180º.
sum	The answer to an addition problem. In 32+4=36, 36 is the sum.
surface area	The total area of the faces (including bases) and curved surfaces of a solid figure.
translation	A transformation that slides a figure a given distance in a given direction. A translation is also called a slide.

trapezoid	A quadrilateral with one pair of parallel sides and one pair of sides that are not parallel.
turn	The transformation that occurs when a figure is turned a certain angle and direction around a point. A turn is also called a rotation.
two-dimensional	A figure that has length and width, but not height. Having area, but not volume. The image on a movie screen is two-dimensional.
vertex	The point at which two line segments, lines, or rays meet to form an angle.
vertical line	A line that has right angles to the horizon. A vertical line is straight up and down.
vertices	Plural of vertex.
volume	The number of cubic units it takes to fill a figure.
whole number	Any of the numbers 0, 1, 2, 3, 4, 5, and so on.
Zero Property of Multiplication	The product of any number and zero is zero. For example, 8x0=0.

Facilitated

Activities

Math III-1,2,&3

Activities

Spatial Reasoning

2-D Geometry

Standard III:

Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 1:

Describe, identify, and create geometric shapes.

Intended Learning Outcomes:

3. Reason mathematically
4. Communicate mathematically
5. Make mathematical connections

Content Connections:

Language Arts: Listening & Communicating I.1, Art I.1,

Math Standard III

Objective 1

Connections

Background Information

Geometry is more than just naming lines and shapes. Geometry also includes moving, combining, and comparing lines and shapes. Students need to explore kinesthetically in order to better understand different geometric ideas and concepts.

Definitions:

- Line – a straight path continuing without end in both directions.
- Point – an exact location in space represented by a dot.
- Line segment – a part of a line with two endpoints.
- Ray – a part of a line that has one endpoint and goes on forever in one direction.
- Horizontal line – a line that is parallel to the horizon. A horizontal line is straight across.
- Vertical lines – a line that has right angles to the horizon. A vertical line is straight up and down.
- Intersecting lines – lines that meet or cross at one point.
- Parallel lines - lines in the same plane that are always the same distance apart - that do not cross.
- Angle – formed by two rays or two line segments with a common end point.
- Right angle – an angle that forms a square corner—measures exactly 90 degrees.
- Obtuse angle – an angle with a measure greater than 90º and less than 180 degrees.

Materials

- ❑ Math Journal
- ❑ 3" x 5" cards
- ❑ pencils
- ❑ colored pencils
- ❑ 12" ruler
- ❑ scissors
- ❑ Power polygons
- ❑ *Geometry Concentration Cards*
- ❑ *Name That Angle* (Elementary Core Academy 2003, grade 3)
- ❑ *Classify Shapes*

- Acute angle – an angle with a measure less than 90º.
- Polygon – a closed plane figure made by three or more line segments.
- Quadrilateral- a four-sided polygon with four sides.
- Pentagon – a polygon with five equal sides
- Hexagon – a polygon with six equal sides
- Octagon – a polygon with eight equal sides
- Parallelogram – a quadrilateral with two pairs of parallel and congruent sides.
- Similar – same shape – not necessarily the same size
- Congruent – having exactly the same size and shape.

Research Basis

Clements, D. H., & McMillen, S. (1996). Rethinking concrete manipulatives [Electronic Verson]. *Teaching Children Mathematics,* 2(5), 270-279. Retrieved July 5, 2004, from Ebscohost database.

This article discusses what mathematical manipulatives are and how they might be used effectively. It also gives definitions of types of manipulatives and how to select and use them effectively.

Pickreign, J. (2000). Alignment of elementary geometry curriculum with current standards [Electronic version]. *School Science & Mathematics*, 100(1), 243-251. Retreived April 24, 2004, from Ebscohost database.

The subject of geometry in the curriculum is an area of concern among educators. This article identifies models for acquisition of geometry with concrete modeling, pictorial modeling, real-world situation, oral language, and symbolic representations.

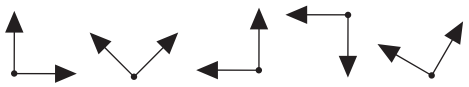
Invitation to Learn

Invite students to come to the floor. Demonstrate to the students each vocabulary word with your body and have students mirror the body positions associated with each geometric term.

- Line – a straight path that is endless in both directions (a line must be straight).
- Point – an exact position on a line.
- Line segment – part of a line with two endpoints—line segments have a beginning point and an end point.
- Ray – part of a line that is endless in one direction—has a starting point but no end point.

- Horizontal lines – lines that go left and right. (across the horizon)
- Vertical lines – lines that go up and down.
- Intersecting lines – lines that cross at one point.
- Parallel lines - lines that do not cross. (lines are same distance apart)
- Angle – formed by two rays or two line segments with a common end point.
- Right angle – an angle that forms a square corner—measures exactly 90 degrees.

Show students what a "right angle" looks like with both arms (in several different ways—going out to the right and other hand down—top right, top left, bottom right, bottom left.



- Obtuse angle – an angle with a measure greater than 90 degrees and less than 180 degrees—greater than a right angle.
- Acute angle – an angle with a measure less than 90 degrees—smaller than a right angle

Have the students stand and play *Geometry Says* (Simon Says): with the geometric terms. When a student gets one wrong, they sit down. The last student standing is the winner. You may want to do this in pairs or triads to give students with the most need for repeated practice partners to work through the experience.

An optional way to assess students' knowledge is to place students into small groups and give a point to the first group that has all the students with the correct position. Or the students as a team have to show the geometric term (standing, connecting arms).

Instructional Procedures

1. After playing *Geometry Says*, have students draw a picture and label each of the geometric terms learned in their math journals. Have the students explain to each other in small groups (think, pair, share) the similarities and differences between the different lines and angles.
2. Give students each a 3"x 5" card. Students will use it to explore right, acute, and obtuse angles in the classroom. Have students discuss their findings with the class.

3. Next, have students describe to their neighbor the difference between square and a triangle. They need to be able to describe these shapes using geometric vocabulary.
4. Teacher demonstrates drawing a shape and describes it with types of lines and angles. For example:

Draw a vertical line segment about one inch long. Next, draw a horizontal line segment that is about one half inch long (half the length of the vertical one) starting at the bottom of the vertical line segment and going to the right making a right angle. Last, draw a line segment that connects the top of the vertical line and the far right of the horizontal line creating two acute angles.

5. Divide the students into pairs. Have each student draw a shape in their math journals using line segments. Then without showing that shape to their partner, describe the shape (using names of lines and angles) they have drawn to see if their partner can produce a shape that is similar.
6. Explain to students the difference between similar and congruent shapes. Using power polygons have students find similar and congruent shapes.
7. Pass out a power polygon and have students draw and describe it in their math journals. After discussing it with the class, have the students label it with the geometrical shape name.
    - Polygon – a closed figure with three or more sides made up of line segments.
    - Quadrilateral- a polygon that has four sides.
    - Pentagon – a polygon with a five equal sides.
    - Hexagon – a polygon with six equal sides.
    - Octagon – a polygon with eight equal sides.
    - Parallelogram – a quadrilateral with exactly two pairs of parallel and thereby also having two pairs of congruent sides.

Assessment Suggestions

- Using students' math journals teachers can assess what students learned.

- Students can demonstrate knowledge of correct geometrical terms by matching pictures to definitions described using *Geometry Concentration* game.
- Students can draw and create a picture labeling lines, shapes, and angles.
- Watching students play *Geometry Says* to see if they can show different lines and angles.
- Other resources: *Name that Angle* (Elementary CORE Academy 3rd grade 2003).
- *Classify Shapes*—one sheet per student.

Curriculum Extensions/Adaptations/ Integration

Line segment star art: You will need white art paper, pencil, ruler, colored pencils, scissors, and contrasting colored paper to mount finished design.

- Place two dots three to five inches apart in the center of the paper. Lightly label the endpoints one and two.
- Connect the two dots with a ruler to create a horizontal line segment.
- Draw about ten dots all over the paper (avoid the horizontal line segment itself and the area if the line segment were extended to the edge of the paper)
- Use a ruler to draw a straight line starting at endpoint one, out to a scattered point, and then from the scattered point to endpoint two.
- Continue the pattern with other scattered dots around the page.
- Design and color each individual section created by intersecting line segments with colored pencils.
- Outline star with black, cut out and place on contrasting colored paper.
- Have students point out an acute angle, obtuse angle, and see if they have any right angles in their design.
- Extend the learning for students with special needs by using students' bodies to demonstrate lines and angles in *Geometry Says*.
- This lesson integrates writing and art with geometry.

Family Connections

- Have students use the 3" x 5" card to find angles at home. Students can write the type of angles they found and bring them back to share with the class the next day.

Additional Resources

Books

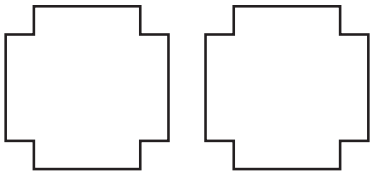
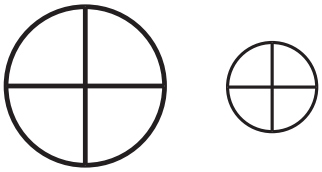
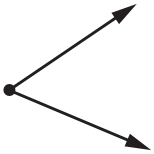
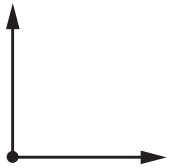
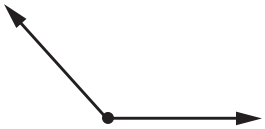
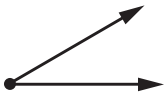
Twizzlers, by Jerry Polatta ISBN: 0613678605

Three Pigs, One Wolf and Seven Magic Shapes by Grace Maccarone & Marilyn Burns ISBN: 0590308572

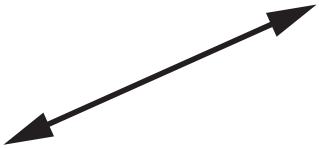
Web sites

http://illuminations.nctm.org

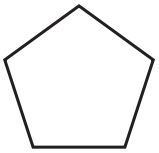
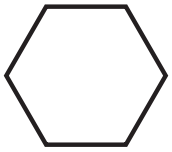
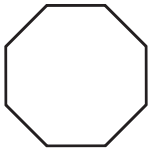
Geometry Concentration Cards

 congruent	having exactly the same size and shape
 similar	same shape – not necessarily the same size
 angle	formed by two rays or two line segments with a common end point
 right angle	an angle that forms a square corner – measures exactly 90 degrees
 obtuse angle	an angle with a measure greater than 90° and less than 180°
 acute angle	an angle that with a measure less than 90°

Geometry Concentration Cards Continued

 parallel lines	lines in the same plane that are always the same distance apart
 line	a set of connected points continuing without end in both directions
 line segment	a part of a line with two endpoints
 point	an exact location in space represented by a dot
 ray	a part of a line that has one endpoint and goes on forever in one direction
 intersecting lines	lines that meet or cross at one point

Geometry Concentration Cards Continued

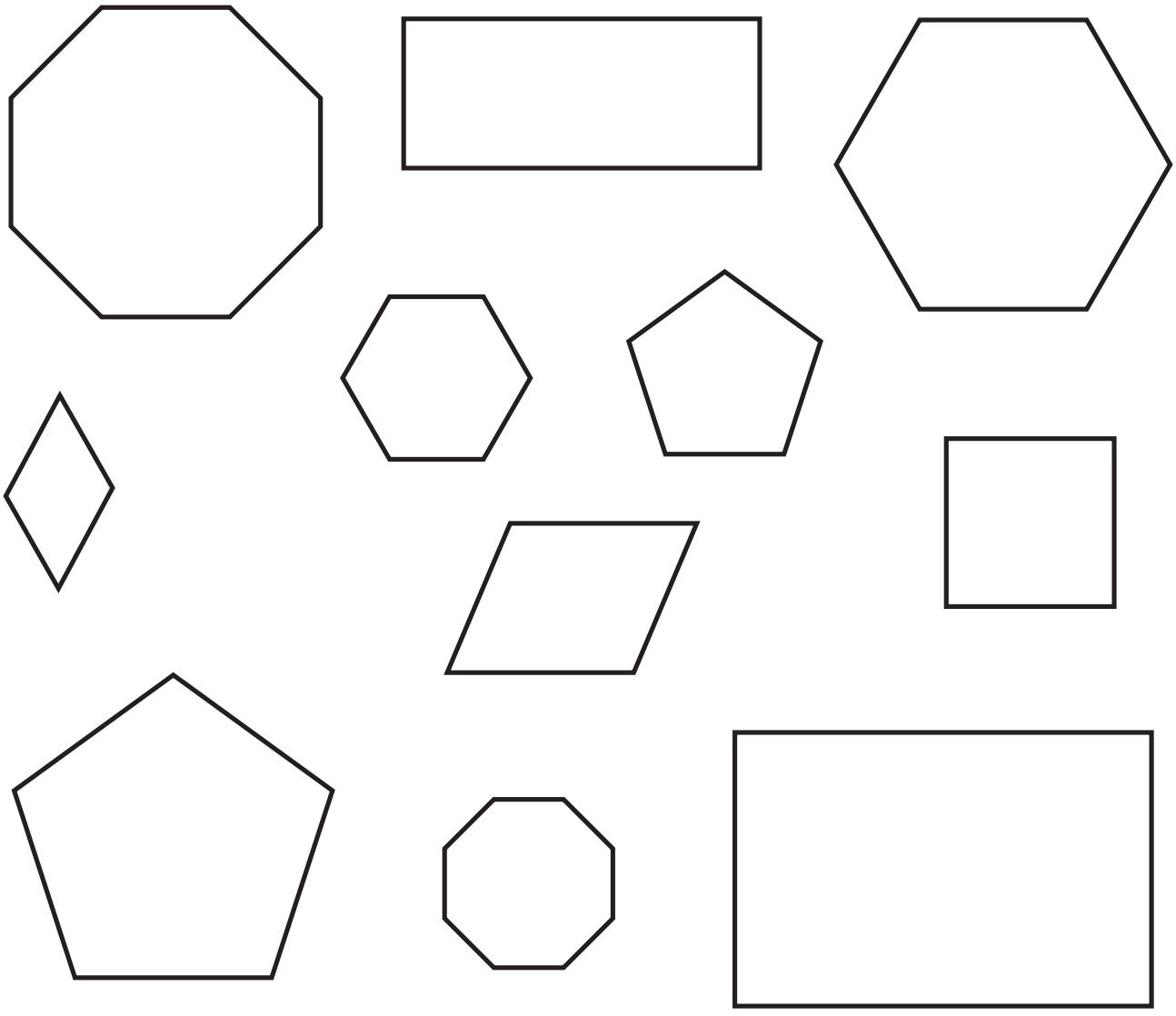
 pentagon	a polygon formed with 5 sides or line segments
 hexagon	a polygon formed with 6 sides or line segments
 octagon	a polygon formed with 8 sides or line segments
 quadrilateral	a polygon formed with 4 sides or line segments
 parallelogram	a quadrilateral with exactly 2 pairs of parallel and congruent sides

Name _____

Classify Shapes

Color or outline the shapes the correct color.

hexagon yellow | **octagon** green | **pentagon** red | **quadrilateral** blue



How many sides does each shape have?

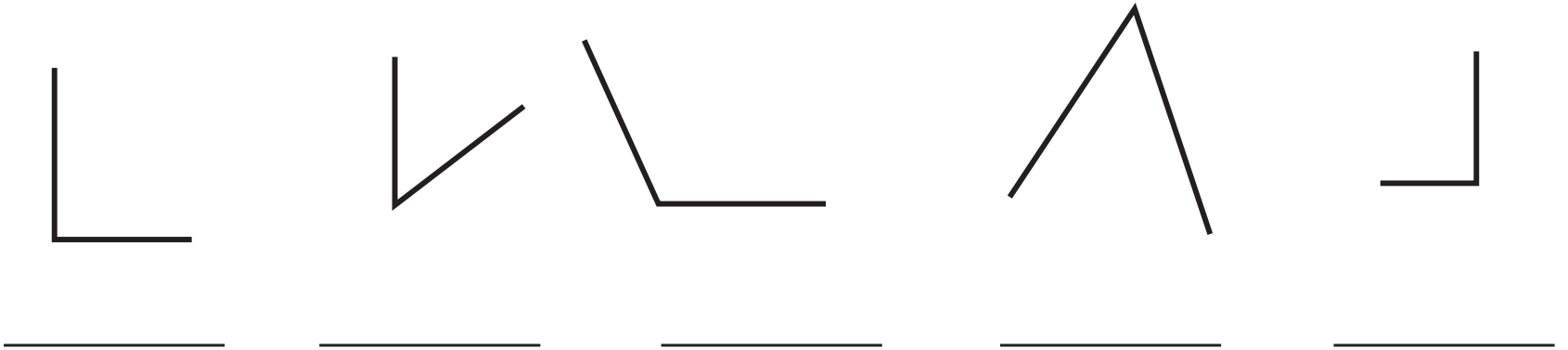
quadrilateral _____ hexagon _____

octagon _____ pentagon _____

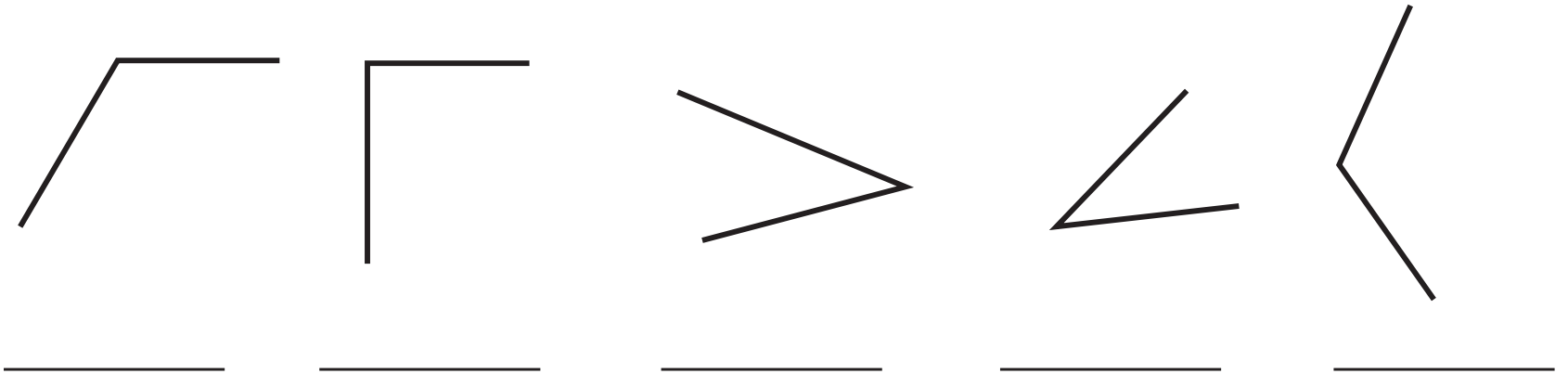
Name _____

Name the Angle

Write acute, obtuse, or right



1 2 3 4 5



6 7 8 9 10

Slides, Flips and Turns

Math Standard III

Objective 3

Standard III:

Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 3:

Visualize and identify geometric shapes after applying transformations.

Intended Learning Outcomes:

1. Demonstrate a positive learning attitude toward mathematics.
2. Become mathematical problem solvers.

Content Connections:

Social Studies mapping VI.1, Language Arts: writing VIII.1-6

Connections

Background Information

Third grade students struggle with developing the spatial sense of transformations such as translations or reflections. Teachers need to give students ample opportunities to help them visualize transformations on shapes.

Definitions:

Slide (translation) – a transformation that slides a figure a given distance in a given direction. A slide is also called a translation.

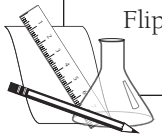
Congruent – having exactly the same size and shape

Flip (reflection) – a transformation creating a mirror image of a figure on the opposite side of a line. A flip is also called a reflection.

Turn (rotation) – the transformation that occurs when a figure is turned a certain angle and direction around a point. A turn is also called a rotation.

Materials

- ❑ Math Journals
- ❑ Pencils
- ❑ Crayons
- ❑ Pentominoes
- ❑ Graph paper
- ❑ *Slides, Flips, and Turns Game Board*
- ❑ Dice (one per two students)
- ❑ Colored Bingo chips (a different color for each team member)
- ❑ "L" shapes
- ❑ Assessment for Slides, Flips, & Turns



Research Basis

Cain-Caston, M. (1996). Manipulative Queen [Electronic version]. *Journal of Instructional Psychology*, 23(4), 270-274.

This is a study which determined the differences in third grade student achievement between using manipulatives verses worksheets.

Fox, T. B. (2000). Implications of research on children's understanding of geometry. *Teaching Children Mathematics*, 6(9), 572-576.

A study which reports research on children's understanding of geometry in the United States.

Invitation to Learn

Ask the students, "How many of you have ever gone down a slippery slide? Who has ever seen anyone do a back flip? Who would like to show the class how you can turn around?"

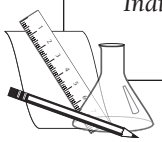
Instructional Procedures

Tell the students that as detectives, they will learn what slides, flips and turns are. Using a large stuffed animal, slide it across the floor and ask what it was doing? Have the students describe it. The animal was sliding across the floor. With your bodies, how would you show a slide?

1. Have the students lie on the floor (on their backs or stomachs) and ask them to show you a move by sliding. If your feet are pointing East to start, where are they pointing after a slide? (same way).
2. Next, have the students demonstrate a flip. Students move from their backs to their stomachs, or their stomachs to their backs. Suggest that they flip on their left side, flip on their right side.
3. If your head is pointing to me when you start, where is it pointing after a flip? (away from me).
4. Right or left flip – the head and feet point in the same direction as before, but what is right is now left and vice-versa.
5. Head or feet flip – the head will be pointing the opposite direction.
6. How could you show a turn? If standing—what does a turn look like? (As in basketball, pivot on one foot so you are not traveling.)
7. If lying on your back what does a turn look like? What was the pivot point?
8. Pass out pentominoes to each student. Have students use a shape (such as the "L" shape from the game) to demonstrate a slide, flip, and a turn. Students will trace the shape in their journals and apply slides, flips, and turns to the shapes. Have students communicate by writing an explanation of how they know the shape was changed.

Materials

- ❑ One die
- ❑ Different colored bingo disks
- ❑ *Slides, Flips, and Turns Game Board*
- ❑ "L" shape
- ❑ *Slides, Flips, and Turns Individual* game board



Slide, Flip, Turn Game

Players: two to four

1. Place colored markers on the direction game board.
2. Roll the die.
3. Move the marker clockwise around the board, and follow the directions in the space where the marker is placed. If there are not enough spaces, player may go until they run out of spaces and they loose the rest of their turn. If there are squares or spaces available, player must move.

Goal: Be the first player to fit their shape into the final "finish" space or be the closest in fine minutes.

Assessment Suggestions

- Informal assessment – observe students as they portray slides, flips, & turns with their bodies
- Journal assessment – students trace and label slides, flips and turns with pentominoes or "L" shape
- Assessment for Slides, Flips, & Turns

Curriculum Extensions/Adaptations/ Integration

Integrating mapping skills for directional skills

Play the *Follow Directions* game

- Teacher gives directions using directional words (north, south, east, west) and slide, flip, or turn for students to follow.
- Choose a student to follow one simple direction. (e.g., walk north five steps) Then choose another student to do the previous direction and add another direction. State only the new direction. Lay down and turn one-fourth turn south. (Students must remember the previous directions.) Continue giving directions for students to listen and follow. Great for listening skills as well.

Additional Resources

Books

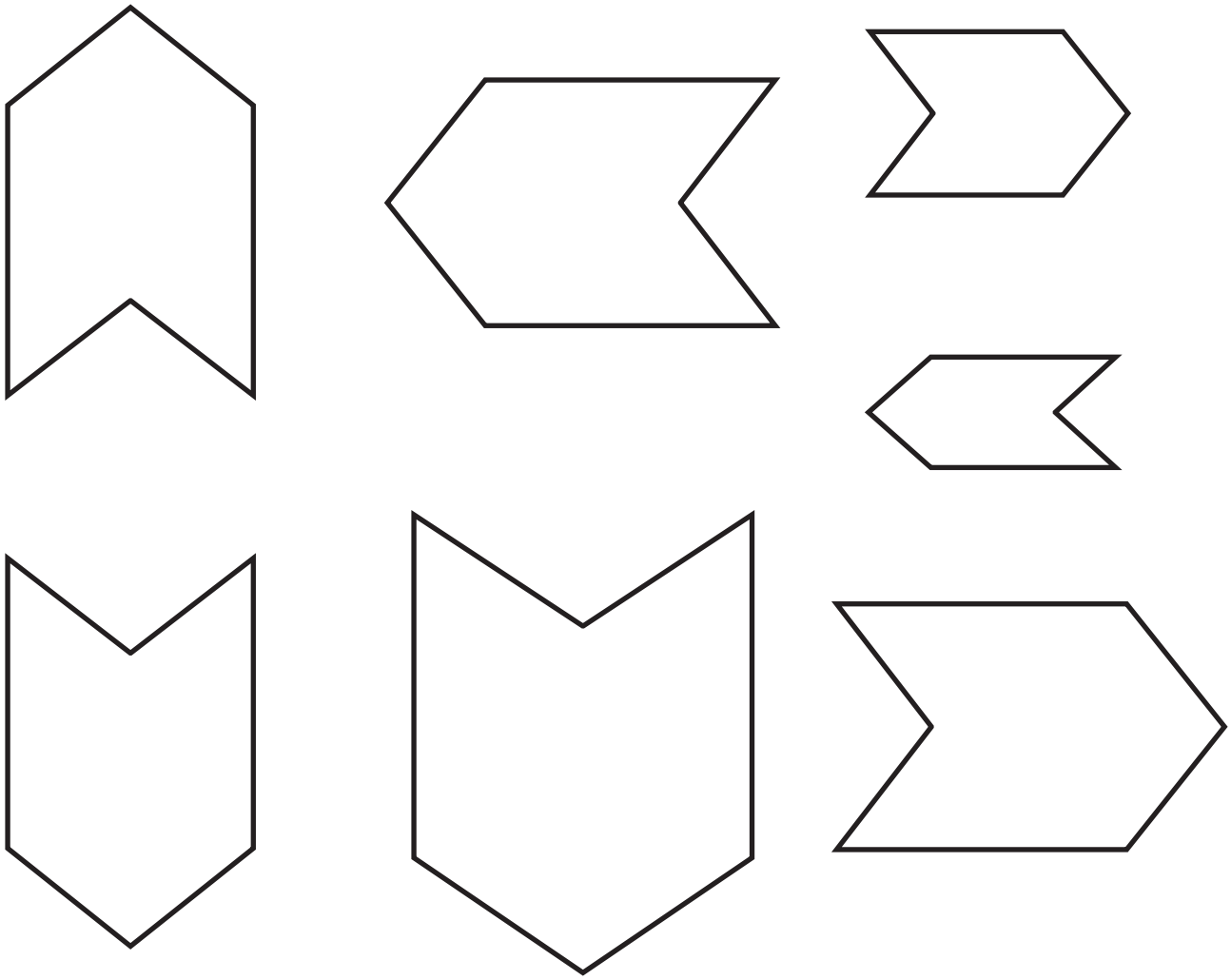
Twizzlers: Shapes and Patterns by Jerry Pallotta ISBN 0613678605

What's Your Angle, Pythagoras? A Math Adventure by Julie Ellis ISBN:1570911509

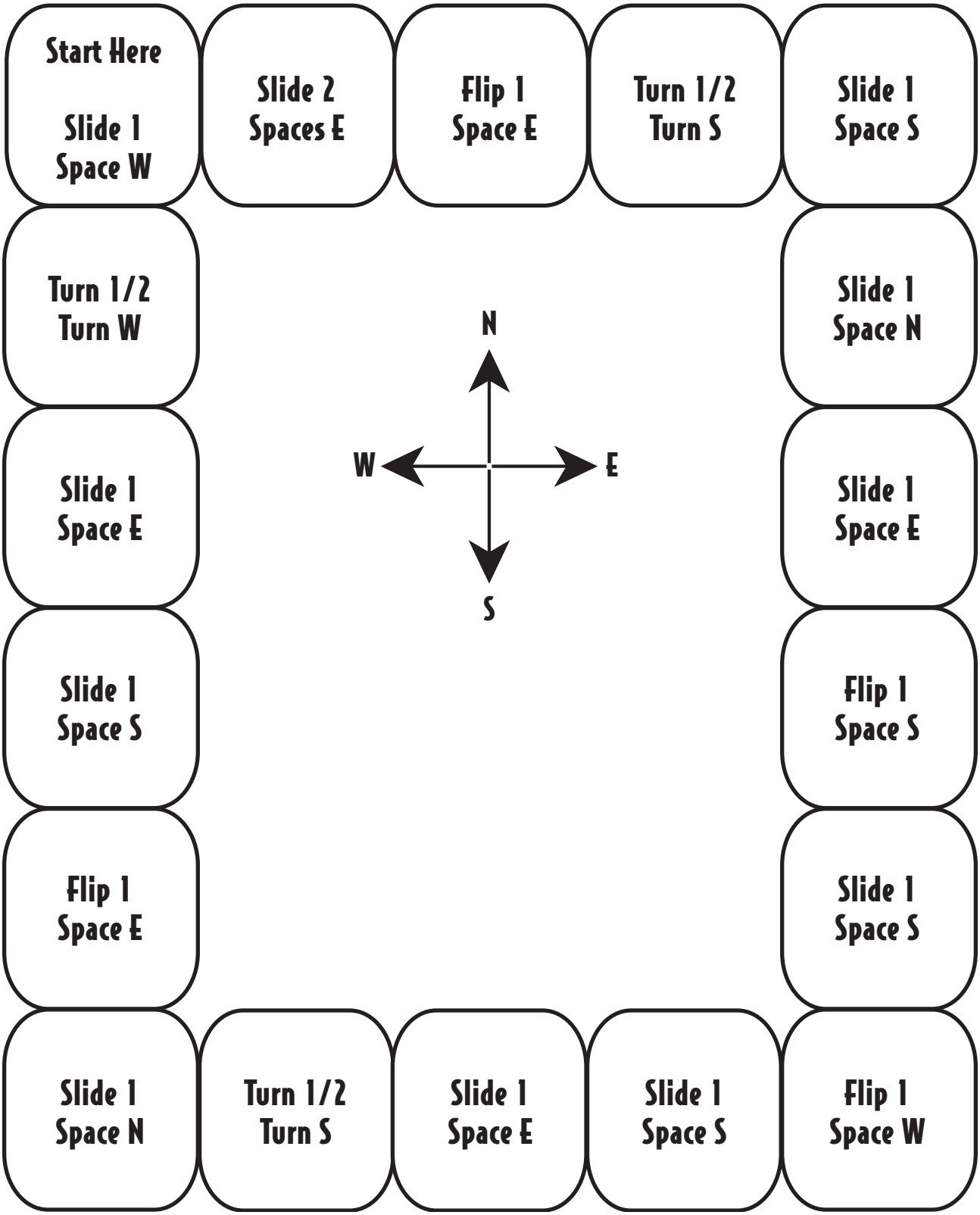
Name _____

Assessment for Slides, Flips, & Turns

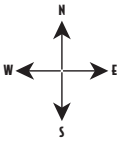
1. Color and cut the shapes that are congruent.
2. Paste one of the shapes on a piece of grid paper and label it #1.
3. Use a second congruent shape to show a slide of the first shape on the grid paper. Paste the second shape on the paper and label it "slide."
4. Use a third shape to show a flip of the first shape on the grid paper. Paste the third shape on the paper and label it "flip."
5. Use a fourth shape to show a turn of the first shape on the grid paper. Paste the fourth shape on the grid paper and label it "turn."



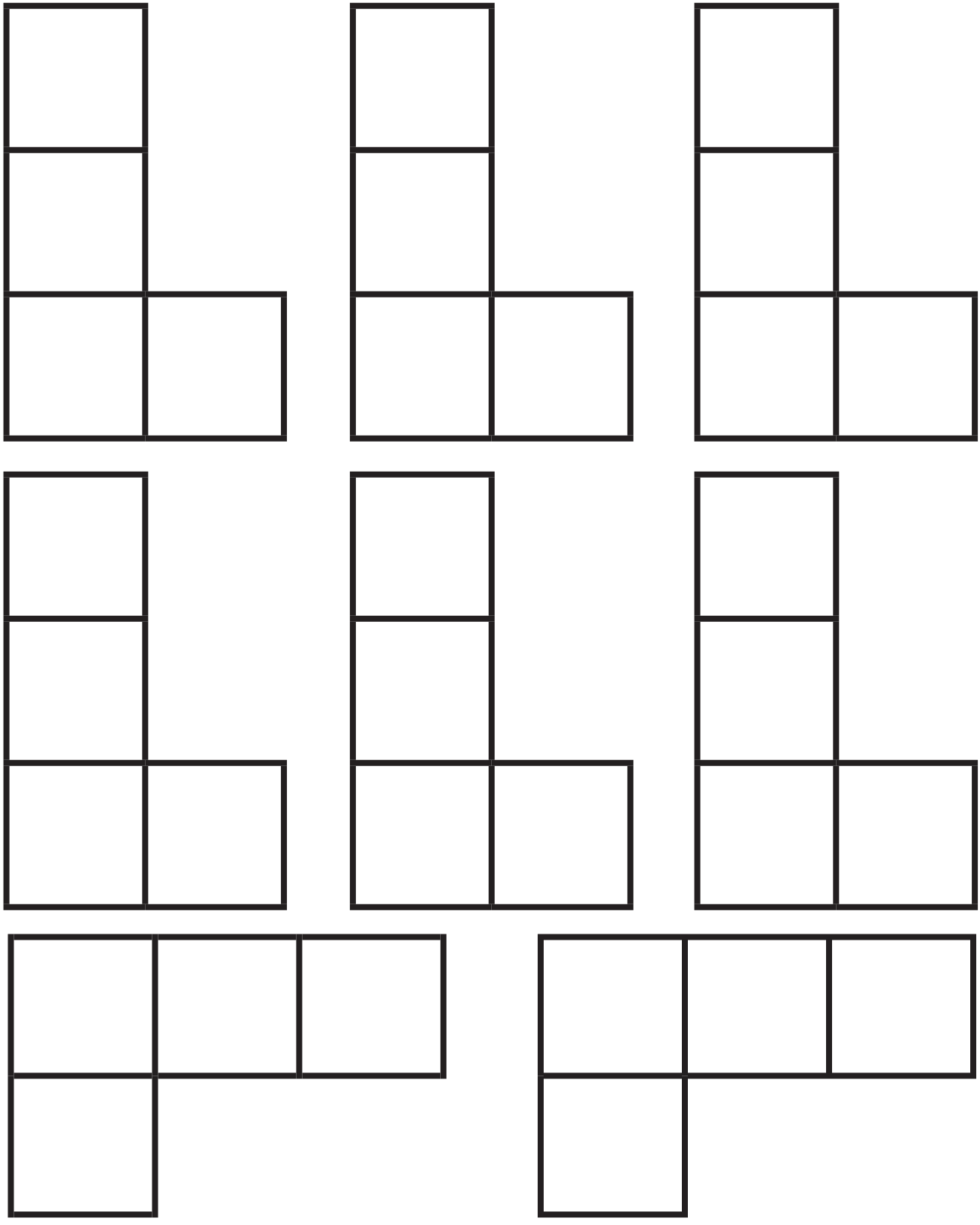
Slides, Flips, and Turns Game Board



Slides, Flips, & Turns Individual Game Board



"L" Shapes



Attributes & Nets of a Cube

Standard III:
Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 3:
Visualize and identify geometric shapes after applying transformations.

Intended Learning Outcomes:
1. Demonstrate a positive learning attitude toward mathematics.
2. Become mathematical problem solvers
3. Reason mathematically

Content Connections:
Language Arts writing VIII.1-6,

Math Standard III

Objective 3

Connections

Background Information

A cube consists of six square faces, twelve edges, and eight vertices. When the square faces of a cube are separated at the edges and laid out flat they make a two dimensional figure called a net. There are eleven different nets for a cube.

- Net – a two-dimensional shape that can be folded into a three-dimensional figure is a net of that figure.
- Face – a plane figure that serves as one side of a solid figure. The faces of a cube are squares.
- Vertex (vertices) – the point at which two line segments, lines, or rays meet to form an angle.
- Edge – the line segment where two faces of a solid figure meet.

Today students will use their knowledge of attributes of cubes, work together in groups and find as many ways as possible to make a cube. A two-dimensional pattern for a three-dimensional shape is called a "net."

Students will work together in small groups and each group will be a different color. They will use tape to piece together shapes that fold into a cube.

Research Basis

Beattie, V., Collins, B., & Mcinnes, B. (1997). Deep and surface learning: A simple or simplistic dichotomy? *Accounting Education, 6*(1), 1-12.

Deep learning verses surface or rote learning is essential for students to gain an understanding for learning. Student learning

Materials

- ❑ Math journals & pencils
- ❑ Three dimensional cubes
- ❑ Attributes of a Cube
- ❑ *An Important Book*
- ❑ Important Writing Stationary
- ❑ Important Booklet Instructions
- ❑ 9"x12" sheet of construction paper
- ❑ 2" squares of colored paper
- ❑ Nets of a cube
- ❑ Scotch tape
- ❑ Nets of a cube (plastic canvas)

processes for deep learning include using different learning styles to enhance student's personality.

Hartshorn, R., & Boren, S. (1990 June). ***Experiential learning of mathematics: Using manipulatives***. Washington, DC: ERIC Clearinghouse on Rural Education and Small Schools, ERIC Digest. (ERIC Document Reproduction Service No. ED321967)

Active involvement with different learning styles will enhance student learning. Because mathematics is so abstract it becomes difficult for students to understand. Therefore, the use of manipulatives is essential for learning.

Invitation to Learn

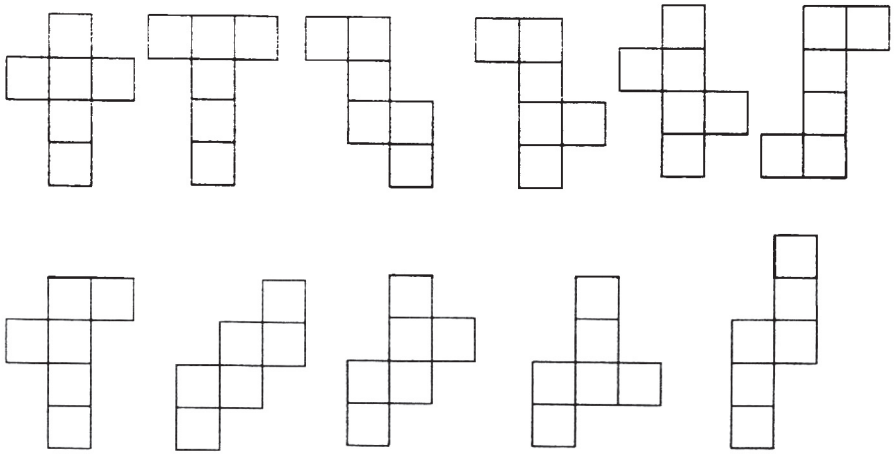
Bring students to the floor. Ask, "who can say what an attribute is? An attribute describes something about an object or person. Call on a student to stand in front of the class and state an attribute of the child (the color of their hair, eyes, shoes, etc.). Today we are going to learn about attributes of a cube.

Read the book *An Important Book* by Margaret Wise Brown

Tell the students that, as detectives, they will be describing the attributes of a cube.

Instructional Procedures

1. As a class choose a two- or three-dimensional object in the classroom (for example: the globe or the flag). Have the students come up with attributes while the teacher lists the attributes on the board.
2. Hold up a cube and discuss with the students the different attributes of a cube making sure they call the "sides" faces. Ask students to write the attributes in their math journals.



the 11 nets for a cube

3. Ask students to look around the room and name items that are shaped like a cube. If it hasn't been brought up, ask students what two-dimensional shapes makes up the cube.
4. Next go over the attributes of a cube. List them on the board. Have the students write them in their journals.
5. Next have the students come up with why they think the cube shape is important. Have them come up with an item in real life that is shaped like a cube and list the attributes. In journals students will come up with a verse for "The important thing about a cube is . . . .
6. After completing the sheet, students may make a booklet of their attributes.
7. Next, students work together in groups of four, using the two-inch squares, to come up with as many different nets for a cube as possible. The students tape the squares together to make different nets. The group with the most different nets for a cube is the winner.

Closure

In math journals, have students come to the floor and write down the attributes of the nets.

- Each net has six squares that when folded properly form the six faces of a cube
- For each net, six faces are connected by five edges

Have students share and write what they learned about a cube.

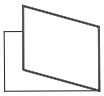
- Cubes have twelve edges
- eight vertices
- six faces

Assessment

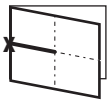
- Students can use graph paper to draw the different ways they found to make a net.
- Student Important book about a cube.
- Journal entries.
- Students create a booklet that will demonstrate the knowledge of attributes of a cube.

An Important Book
Instructions:

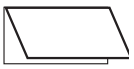
1. Fold a 12"x18" piece of manila construction paper in half horizontally and then open it up and lay it flat again.



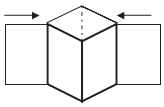
2. Next, fold it again vertically 2 times (fold in half and in half again)



3. Unfold once. Cut on the fold to the middle fold line, and open up paper.



4. Now fold the paper horizontally.



5. Squeeze the ends toward the center, fold and crease.
6. Small booklet makes 8 pages.

a. 1 page – cover
b. 1 page – back
c. 6 inside pages

Ways to use the book: Most important thing about: 3rd grade, a new friend I met, fractions, geometric shapes, etc. (Great idea when using attributes.)

Assessment Suggestions

- Concentration game with attributes of a cube
- *I Have: Who Has?* game

Curriculum Extensions/Adaptations/ Integration

- Great for integrating Language Arts and writing into mathematics

Family Connections

- Students go on a scavenger hunt for "cube" shapes at home

Additional Resources

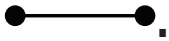
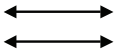
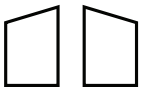
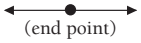
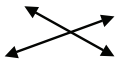
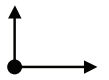
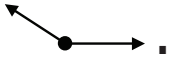
Books

A*n Important Book* by Margaret Wise Brown ISBN: 0064432270

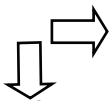
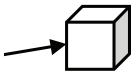
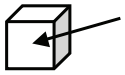
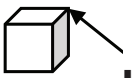
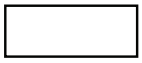
Web sites

http://illuminations.nctm.org

I Have Who Has Geometry Game Cards

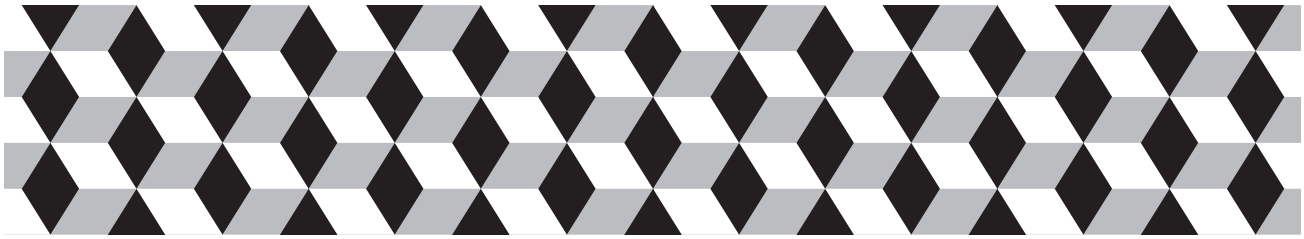
I have a  . Who has a sphere?	I have a  . Who has parallel lines?
I have a  . Who has a line segment?	I have  . Who has a cylinder?
I have a  . Who has a cube?	I have a  . Who has an acute angle?
I have a  flip. Who has a right angle?	I have an  . Who has intersecting lines?
I have an  Who has a flip?	I have  . Who has a pyramid?
I have a  . Who has a point?	I have a  Who has an obtuse angle?
I have a  . Who has a pentagon?	I have an  . Who has a hexagon?

I Have Who Has Geometry Game Cards

I have a  slide. Who has an octagon?	I have a . Who has a triangular prism?
I have an  . Who has a line of symmetry?	I have a  . Who has a cone?
I have a  turn. Who has a rectangle?	I have a  . Who has a turn ?
I have an  . Who has a ray ?	I have a  . Who has a vertex?
I have a  . Who has an edge?	I have  (congruent). (same size and shape) Who has a face of a cube ?
I have a  Who has same size and shape (congruent)?	I have a  . Who has a slide ?
I have a  . Who has a line ?	

Name _____

An Important Thing



The important thing about a cube is _____

_____

It has _____

_____

_____

It is like _____

_____

It doesn't have _____

_____

It can be found _____

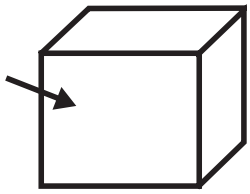
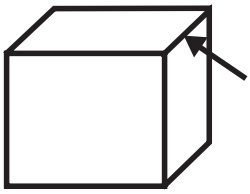
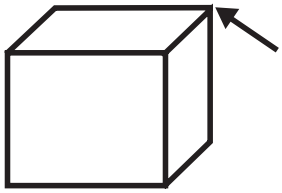
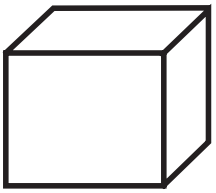
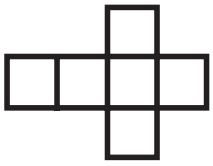
_____

But the important thing about a cube is _____

_____

_____

Cube Attribute Cards

 face	A plane figure that serves as one side of a solid figure. The faces of a cube are squares.
 edge	The line segment where two faces of a solid figure meet.
 vertex	The point at which two line segments, lines, or rays meet to form an angle.
 cube	Having 6 square faces, 12 edges, and 8 vertices.
 net of a cube	A two-dimensional shape that can be folded into a three-dimensional figure is a net of that figure.

Science I-1&2

Activities

Earth & Moon

The Night Sky

Standard I:

Students will understand that the shape of the Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Objective 2:

Describe the movement of Earth and the moon and the apparent movement of other bodies through the sky.

Intended Learning Outcomes:

1. Understand Science Concepts and Principles.

Content Connections:

Math V- 1 (Collect, organize, and display data to make predictions.)
Language Arts VI- 1 (Learn new words through listening and reading widely.)

Science Standard I

Objective 2

Connections

Background Information

Until about 400 years ago, most people thought Earth to be the center of the universe with everything else revolving around it. Copernicus was one of the first astronomers to study the idea of a "sun-centered universe." Galileo and many others later proved his theory correct. With this discovery came the knowledge that Earth rotated on an axis causing the sun and the stars to appear to move across the sky.

Some students may already know that Earth rotates on its axis and revolves around the sun but probably can't explain why it seems that the other bodies appear to move through the sky. This lesson will allow students to draw conclusions to come up with their own explanations.

Research Basis

Jarrett, Denise. (1999). The inclusive classroom: Mathematics and science instruction for students with learning disabilities. *It's just good teaching*.

This article discusses the benefit of using "Inquiry-Based Science" or in other words posing a question to students and providing activities and/or experiments to allow students to discover the answers to scientific questions themselves rather than just being told. The article talks about using varied levels of inquiry depending on the age and ability of the learners. The article poses the argument that inquiry based learning is a good way to help students with disabilities to be involved in the learning process in the regular classroom.

Materials

- ❑ Glow in the dark crayons, chalk, or paint
- ❑ White butcher paper
- ❑ *Night Sky Recording Sheet*
- ❑ Wheeled scooter or chair.
- ❑ *The Librarian Who Measured the Earth*
- ❑ Desk lamp to represent the sun
- ❑ Time cards that correspond with *Night Sky Recording Sheet*

Invitation to Learn

Share parts of the book, *The Librarian Who Measured the Earth*. Talk about how inquiry drives discovery of new things and compare it to the curiosity of the main character Eratosthenes in the book. Explain to the class that we will be discovering the answer to a question posed by scientists many years ago.

Encourage students to think of questions like Eratosthenes in the book. Discuss questions that students may have about the earth, moon, stars etc. and use these questions to lead into the following activity.

Instructional Procedures

Read *Moonhorse* by Mary Pope Osborne. Talk about constellations and how they are a group of stars that form a pattern.

As a class create a night sky using white butcher paper and glow-in-the-dark crayons. Each group of two to three students takes a section of the butcher paper and draws different constellations. Use constellation books (see references) or websites to show students which constellations are visible in the Northern Hemisphere and during the current season. Assign each group a specific constellation to draw on their piece of paper. Add other stars around it. Post them on the walls around the classroom. Put cards with different times of the night across the top.

1. Pose the questions: Why does it seem that the sun moves across the sky during the day? Why does it seem that the moon and stars move across the sky at night.
2. Discuss previous knowledge of the night sky and of movements of Earth, moon, and stars.
3. Have students make a prediction as to why the objects in the sky appear to move across the sky and record it in their journal.

Earth

1. Discuss with students the rotation of Earth.
2. Darken the room and have a student representing Earth sit on the scooter (or chair) and slowly spin the scooter in place. Student will face their body toward each time represented by the cards and sketch the constellations that they see. You may need to turn on the lights in between each time so that students can see to sketch. They then turn to the next time card and

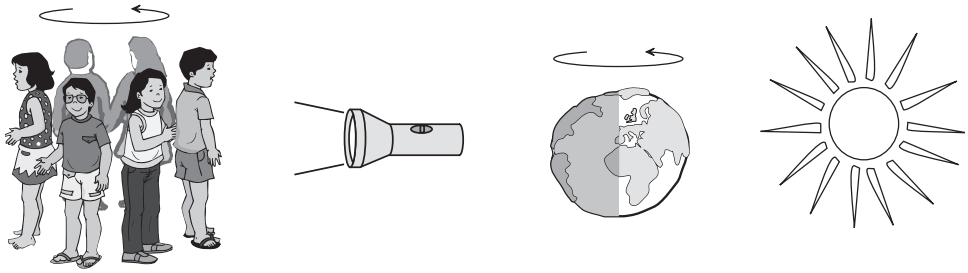
sketch what they see in each time block on the Night Sky worksheet.

The Moon

1. Repeat activity, this time focusing instead on the movement of the moon using a student as "the moon" to show the rotation and revolution of the moon. This time the student representing the moon walks around the student representing Earth, always facing Earth, while the earth rotates. Explain to students that the moon only makes it around the earth once for every 27 rotations of Earth.

The Sun

1. Show the apparent movement of the sun. Start by using four students to represent the Earth. The teacher holds a lamp to represent the sun. Students each pick a different city from around the world and write it on a sign. Students stand in a circle facing outward. Students rotate together slowly and observe the light from the "sun." Explain that when they are facing the sun it would be 12:00 noon and facing away would be 12:00 midnight. Students can sketch the position of the "sun" at different times of day in their journal.



2. Students write their conclusion as to why these objects appear to move across the sky. Lead students to the conclusion that scientists discovered in that it is because Earth itself is moving.

Assessment Suggestions

- Students complete journal activities or dictate them to a partner.
- Pose the question "Does the sun move?" and "Do the stars move?" and have students write a sentence or two to answer. This could also be used as a pre-assessment.

- Observe students as they work.

Curriculum Extensions/Adaptations/ Integration

- With the student representing the sun in the middle of the room, "gravity" will slowly pull "the earth" around the sun as the student representing the earth records the major stars he or she sees in the night sky during each season. (Each quarter of the room can represent a different season). Activity can be repeated with students in pairs representing earth and gravity so that each student has an opportunity to record what he or she sees in the "night sky" during each season.
- Literature connection - after reading about different constellations and the legends that they originated from have students make their own constellation by dropping paper stars (or bits of paper) on a black piece of paper and connecting them to make a new constellation. Students can then write their own legend about the origin of their constellation.
- Pair learners with special needs with classmates of different abilities.
- Allow students with special needs to dictate journal activities to a partner.

Family Connections

- Study the stars at home. Sketch the real sky at different times during the day with the same procedure and worksheet used in the classroom activity.

Additional Resources

Books

The Librarian Who Measured the Earth, by Kathryn Lasky; ISBN 0-329-0444403

Don't Know Much About Space, by Kenneth C. Davis; ISBN 0-439-43850-0

Eyewitness Books: Astronomy, by Kristen Lippincott; ISBN 0-75660656-X

Space: A Nonfiction Companion to Midnight on the Moon (Magic Treehouse Research Guide Series) by Mary Pope Osborne; ISBN 0-375-81356-x

Moonhorse, by Mary Pope Osborne; ISBN 0-679-86709-0

The starlore handbook: An essential guide to the night sky by Geoffry Cornelius; ISBN 0-811-816044

Web sites

http://skymaps.com/articles/index.html

http://www.caosclub.org/members/earth29.html

http://www.astrologyweekly.com/zodiac-picture/zodia-constellation-pictures.php

http://www.seasky.org/pictures/sky7b.html

Name _____

The Night Sky Recording Sheet

Question: Why does it seem that objects like the sun, moon, and stars move across the sky?
Gather Information:

_____

_____

Hypothesis: I think that

_____

_____

Experiment: Draw what you see at each time in the appropriate box as you "rotate".

Earth

11:00 p.m.
1:00 a.m.
3:00 a.m.

5:00 a.m.
10:00 a.m.
3:00 p.m.

Conclusion: The sun, moon, and stars appear to move across the sky because:

Time Cards

5:00 a.m.	11:00 p.m.
10:00 a.m.	1:00 a.m.
3:00 p.m.	3:00 a.m.

Earth is Round?

Standard I:

Students will understand that the shape of the Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Objective 1:

Describe the appearance of the Earth and moon.

Intended Learning Outcomes:

1. Understand Science Concepts and Principles.

Science Standard I

Objective 1

Connections

Background Information

Students probably know that Earth is spherical, but you can have a discussion about how Aristotle came to this conclusion so long ago and what it might have been like if Earth were flat.

Some people think that Christopher Columbus' voyage in 1492 proved that Earth was round. However, Aristotle's studies proved this nearly 2000 years before Columbus. Aristotle had two arguments: first, that during a total lunar eclipse Earth casts a curved shadow on the moon. He concluded that Earth would have to be spherical. Second, the fact that a person who traveled north or south would be able to see new stars that hadn't been visible before. If Earth were flat people would all be able to see the same stars. During a lunar eclipse Earth comes between the Sun and the moon and casts a shadow on the moon.

Research Basis

Furner, Joseph M., Yahya, Noorchaya, and Duffy, Mary Lou. (2005). 20 Ways to teach mathematics: Strategies to reach all students. *Intervention in school and clinic,* Volume 41, No. 1 (September 2005), Pages 15-23.

This article gives 20 ways to teach mathematics, but applies very much to teaching science as well. It talks about using concrete objects to explain abstract concepts and allow a lot of hands-on activities. It also talks about heterogeneous grouping for cooperative learning. Other tips in the article include using children's literature, Internet field trips, word bank charts, and auditory, visual, and kinesthetic approaches.

Jarrett, Denise. (1999). The inclusive classroom: Mathematics and science instruction for students with learning disabilities. *It's just good teaching.*

This article discusses the benefit of using "Inquiry-Based Science" or in other words posing a question to students and providing activities and/or experiments to allow students to discover the

Materials

- ❑ Globe pattern
- ❑ Tennis balls
- ❑ Small styrofoam ball
- ❑ Small desk lamp
- ❑ 18" x 9" construction paper
- ❑ Shoebox
- ❑ Scissors
- ❑ Flashlight
- ❑ Spool of thread
- ❑ Glue
- ❑ The Moon

answers to scientific questions themselves rather than just being told. The article talks about using varied levels of inquiry depending on the age and ability of the learners. The article poses the argument that inquiry based learning is a good way to help students with disabilities to be involved in the learning process in the regular classroom.

Invitation to Learn

Have students draw any geometric shape on their paper. After everyone has drawn their shape tell the students to add seven large land masses on their shape. Tell each student to color the land masses brown and the remaining areas blue to represent the ocean. Tell students to imagine what it would be like if Earth were the shape of their drawing. Have students list on their paper different problems that might come about because of their shape. Allow students to present their geometric "Earths" and talk about the possible problems of the different shapes.

Instructional Procedures

Talk about how Aristotle discovered 2000 years before Columbus that the Earth is round. Talk about misconceptions and different theories that existed anciently. Take an imaginary trip around a "flat world". Play *What If* posing questions on how life would be different.

1. Present a flat model of the Earth and change it to a spherical model by cutting it and wrapping it around the tennis ball.
2. Journal Activity:

   Students pose the question: How do we know that Earth is round? Have them record any previous knowledge or experience and information from your previous discussion.

   Hypothesis: Students record their own hypothesis of how we know that Earth is round in their journal.
3. Experiment: Recreate Aristotle's discovery. Use the students' models of Earth, a lamp to represent the sun, and a small foam ball to represent the moon to model the eclipse that Aristotle saw which proved that Earth is in fact round.

   Place the lamp in the middle of the room and darken the rest of the room. One student holds the foam ball in the light of the lamp. Another student uses his or her model of Earth to cast a shadow on the moon.

Students draw what they see in their journals and make a conclusion. Discuss with the class how Aristotle discovered that Earth was round.

Captain's Log

Now that students are familiar with the shape of Earth, let's talk about the moon.

1. Students make a shape book of the moon by cutting out several circles about six inches in diameter.
2. Read aloud and discuss *The Moon* by Seymour Simon. Students pretend they are the captain on a trip to the moon and will record everything they see (hear in the story) for the people back on Earth. As you read students will write a sentence in their moon book and draw a picture for each page of the story, describing the appearance and characteristics of the surface of the moon.

Moon Box

1. Journal- Write the question: Why does the moon appear to change shape? Gather information to determine students' previous knowledge. Have students record their hypothesis in their journal.
2. Students will make a model of the phases of our moon. Cut a hole in one end of the shoebox big enough to shine the flashlight through. Cut eight small holes (big enough to see through) all around the sides of the box—one on each short end and three on the longer sides. Glue the spool of thread inside the box and glue the tennis ball on top of the spool. Shine the flashlight through the big hole and look in each hole, observing the image of the moon and how it changes. Number the holes and students will sketch what they see in corresponding boxes on the recording sheet. Discuss with students the names of each of the phases of our moon and label them accordingly on the recording sheet.
3. Discuss with students that instead of moving around the moon like we did in the experiment, the moon actually revolves around Earth, but the sun remains stationary. Lead students to the conclusion that the moon changes shape because of the location of Earth in relation to its moon. Have students record their conclusion in their journal.

Assessment Suggestions

- Observe and question students.
- Journal activities
- Shape book

Curriculum Extensions/Adaptations/ Integration

Literature: Read and discuss *Kids Discover: Moon* magazine.

Use posters from http://www.edugraphics.net/ge1-geology/ge110-sh.htm that show different images of Earth if it were a different shape to further the discussion in the invitation to learn.

Video: *Bill Nye the Science Guy: The Moon*

Family Connections

Students share their moonbox with someone at home and challenge them with the scientific questions discussed in class.

Additional Resources

Books

Don't Know Much About Space, by Kenneth C. Davis; ISBN 0-439-43850-0

Eyewitness Books: Astronomy, by Kristen Lippincott; ISBN 0-75660656-X

The Moon by Seymour Simon; ISBN 0-439-79644-X

The Best Book Of The Moon by Ian Graham; ISBN 0-7534-5174-3

Kids Discover: Moon (Kids Discover, 149 Fifth Avenue, New York, NY 10010, kidsdiscoverteachers.com): Moon

365 Science Projects And Activities by Phyllis J. Perry and Peter Rillero, Ph.D.; ISBN 0-7853-1592-6

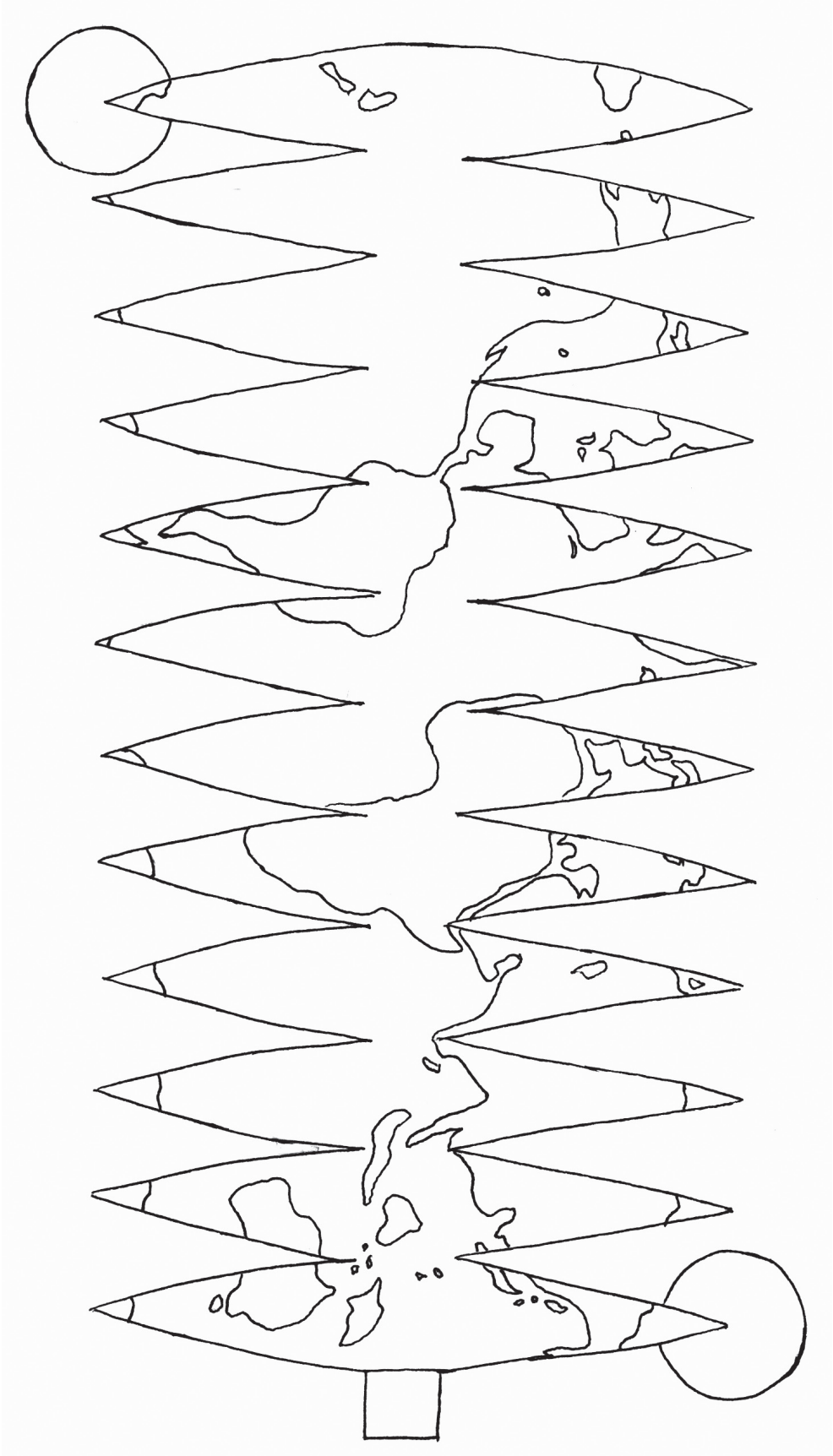
Websites

http://www.edugraphics.net/ge1-ge110sh.htm

Videos

Bill Nye the Science Guy: The Moon by Disney Educational Productions ((800)295-5010, www.Edustation.Disney.com)

Tennis Ball Globe



Math I-2,3,4,&5

Activities

Number Sense

100 More 100 Less

Standard I:

Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 2:

Identify relationships among whole numbers.

Intended Learning Outcomes:

1. Communicate mathematically.
2. Make mathematical connections

Content Connections:

Place value, expanded notation

Math Standard I

Objective 2

Connections

Background Information

Students will review the concept of place value and how it relates to number sense. Children with strong number sense possess place value knowledge and they can explain the value of a three when they see it in the 100's place. This concept is foundational when beginning the process of what is 100 more or 100 less. Children with good number sense can compare the relative sizes of numbers and place number is order from greatest to least or least to greatest.

Research Basis

Hartshorn, Robert, & Boren, Sue. (1990). Experiential learning of mathematics: using manipulatives. *ERIC Source* (ERIC ED321967). Retrieved March 12, 2004, from Ebscohost database.

This article discusses the idea of how students achieve active involvement in their learning with manipulatives. It also discusses the positive effects and the new interest that manipulatives bring to student mathematical education.

Cain-Caston, M. (1996). Manipulative queen [electronic version]. *Journal of instructional psychology*, 23(4), 270-274.

This study focused on students practicing with manipulatives in mathematics usually out perform those who do not. Using manipulatives increased scores on retention and problem solving tests.

Materials

- ❑ Die-cut paper digits 0-9 (several)
- ❑ Paper greater than less than signs (optional)
- ❑ Construction paper
- ❑ Base Ten Block Stamps (teacher)
- ❑ Math Journal

Invitation to Learn

Students will be given race number bibs. Students will look at their bib number and then locate a student in the room that has a

similar number (either 100 more or 100 less). Then have students put themselves in order of smallest number to largest number at the back or front of the class. This will help students when learning to compare numbers.

Instructional Procedures

1. Pass out two different digits to all the students (To start, give students the number for their birthdate).
2. They need to make a two-digit number.
3. The instructor will model questions with the students (see bulleted questions below).
4. Students can then ask each other the questions. While the students have two digits they can make two different numbers.
   - What is the number?
   - Is it odd or even? How do you know?
   - What is 100 more? What is 100 less? What is 10 more? etc.
   - What is the value of the two?
5. During the partner work this is a good time to assess and learn what the children know about reading numbers.
6. After a few minutes of discussion, come back as a whole group and ask all the odd numbers to stand up. Give students the opportunity to hold their number up and explain why it is odd or even. Ask them some of the same questions they just answered with their partner.
7. After everyone has practiced with two digits. Give each student another digit.
8. Repeat the questions and record the numbers created in their math journal.

Activity 2: Number Books

1. The students will make a *100 More, 100 Less, 10 More and 10 Less* book by folding at least three, 8 ½ x 11 pages horizontally.
2. Students will write the title and author on the outside of the cover of the book.
3. On the inside flap of the book, paste in a three-digit number, using the digits that you've used previously in this lesson. Below the number, students need to write the following items to describe the standard numeral:

- Word name (i.e. three hundred sixty eight)
- Expanded notation
- Representation with base 10 blocks (use the stamps)
- Odd or even
- Write out—368 is 100 more than...

4. Students will then work on the next page with a new number that is now 100 more than the number on the first page.
5. Repeat the above list for each new number.
6. For the third number students will then write about a number that is 10 less.
7. Fourth number will be 100 less.
8. Fifth number will be 10 more.

Assessment Suggestions

- Students will create a poster or a book to display the numbers they have used. The poster should show two numbers side by side (345 > 234) and also should be labeled with even or odd, show expanded notation for both numbers, have the word name written out, and have the ones, tens and hundreds place labeled.

Curriculum Extensions/Adaptations/ Integration

- Give advanced learners more digits, as they may be ready for larger numbers.
- Students that need more help may only be able to work on numbers with three digits.
- Students can go out to the school parking lot and look at license plates and record them in their journal, then they can write what is 100 more, 100 less, 10 more and 10 less.
- Arrange students in groups of thee to four and give each student cards with numbers (12" x 15"). Have students make the largest number possible using all the cards in their group. Compare group numbers. Make the smallest number, the largest odd or even number, or have students make numbers with the highest tens place.
- White board extension activity—have two to five students come to the front of the room and hold a small white board. Write a

number on the first white board such as 73. On the next white board write a number that is 100 more, and then ask the class to complete the pattern. Use other numbers to create patterns.

- *Just Try To Top It* – Play this game, which is similar to the number game War. Students divide a deck of number cards. Have students create the largest number, as they each turn over the next card in the deck, creating three or four digit numbers. The child with the largest number wins, the game ends when all the cards are gone. Encourage students to say the number to their partner giving practice reading and communicating the numbers.

Family Connections

- Children and parents can recreate the number book at home using their parent's favorite number, the number in their street address, or the three or four digit number in their phone number.
- Send a note home encouraging parents to send their child to school wearing a number shirt for "Number Shirt Day".

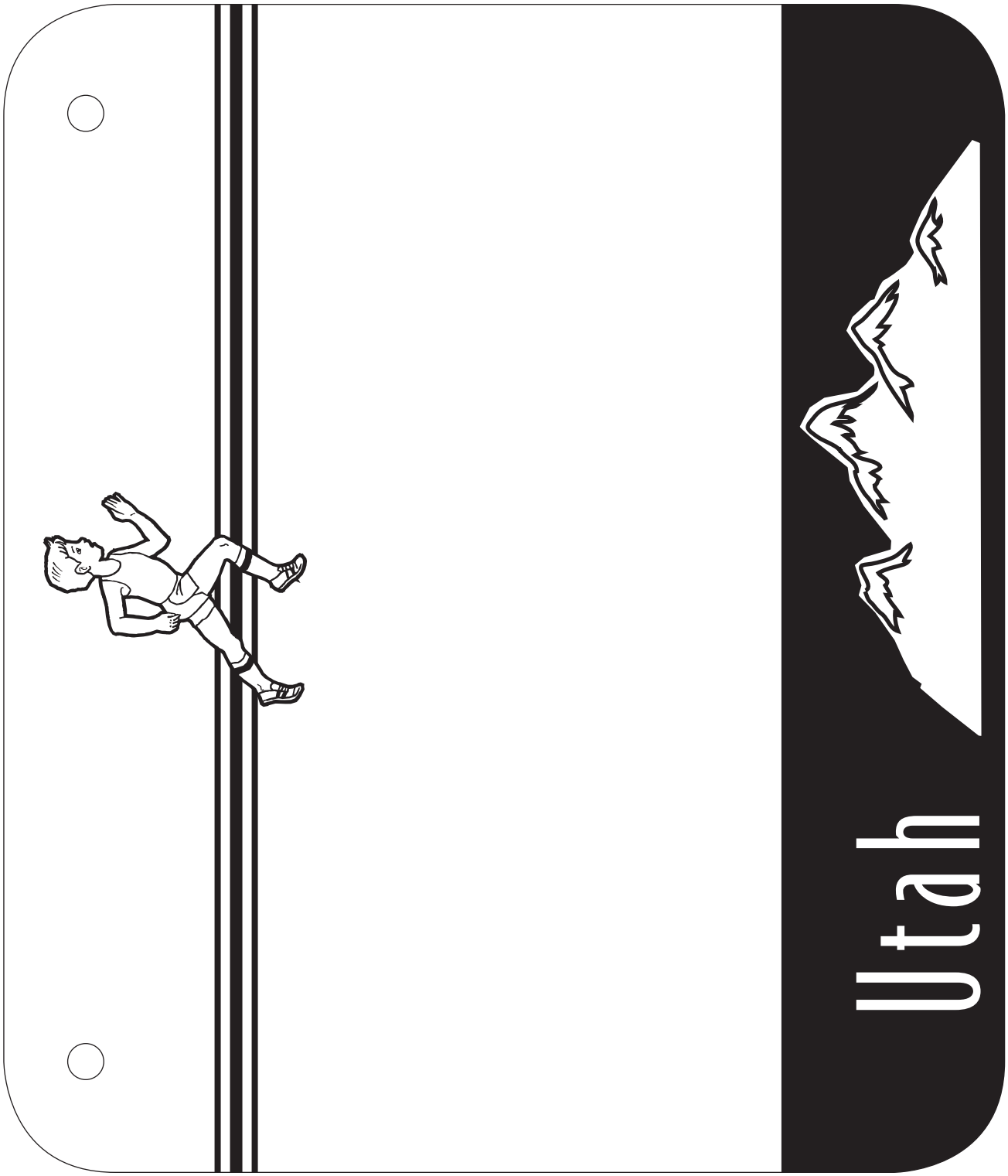
Additional Resources

Books

Arithme-Tickle, J. Patrick Lewis ISBN 0-15-216418-9

Mathematickles!, Betsy Franco ISBN 0-689-84357-7

Race Bib



Unequal Groups vs. Equal Groups

Math Standard I

Objective 3

Standard I:

Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 3:

Model and illustrate meanings of the operations of addition, subtraction, multiplication, and division and describe how they relate.

Intended Learning Outcomes:

1. Become mathematical problem solvers.
2. Make mathematical connections.

Content Connections:

Repeated addition, arrays

Connections

Background Information

Students are often taught the difference between addition and multiplication is the symbol (+, x) between the addends or the factors. In this lesson students will be looking at story problems and then analyzing whether the story is talking about equal groups or unequal groups. Students will need to be able to look at a visual representation of equal groups and write about what they see.

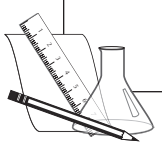
Research Basis

Krpan, Cathy Marks, 2001. *The write math writing in the math class*, Dale Seymour Publications, pg. 4

"Students need a solid grasp of mathematical concepts in order to function successfully in an ever-changing world. To facilitate this, educators must provide opportunities for students to deepen their understanding of mathematics. We can accomplish this by engaging students in exploring mathematical ideas and concepts through writing. When students write about mathematics, they think about abstract ideas in a more meaningful way and make connections between what they already know and what they are learning."

Materials

- ❑ Unifix cubes (20)
- ❑ *12 Ways to Get to 11*
- ❑ One chenille stem per student
- ❑ Eleven colored beads for each student
- ❑ 12 x 18 art paper



Invitation to Learn

Pass out chenille stems and beads. Students need to put 11 beads on their chenille stem. After the beads are on the chenille stem, bend the ends up slightly (make a right angle) to prevent the beads from coming off.

As the teacher reads *12 Ways to Get to 11*, by Eve Merriam, the students listen to the words and move their beads from one end of the chenille stem to the other, based on the numbers that the book provides.

After reading the story, see if they can ever slide the beads over in an equal group. Share solutions or strategies and have students discuss their reasoning.

Instructional Procedure

1. Students will continue to use their chenille stem, however, give each student another bead. Ask the class to then see if they can slide the beads over in equal groups and how many kinds of equal groups can they make with twelve beads?
2. List on the board or overhead what kind of equal groups they come up with: 2 x 6, 6 x 2, 3 x 4 etc.
3. Prepare your students to work as a team. Pass out one 8 ½" x 11" sheet of paper per group, folded into six parts. Each team needs to brainstorm things that come in groups of two, groups of three, groups of four, groups of five and groups of six.
4. When the brainstorming has concluded, share ideas as a large group.
5. Then have students write in their math journal their favorite number between two and seven and then choose their favorite items from brainstorming sheets.
6. Students will begin a rough draft for making a picture of equal groups based on the number they chose and the items they liked (e.g., six skateboards with four wheels).
7. The teacher will model how to write a story from the ideas and numbers they have chosen.
   - Use the beginnings of sentences from the story *12 Ways to Get to 11* to model how to start a sentence for their mathematical problem.

Part 2

8. Students will then transfer this story onto a 12" x 18" piece of art paper (folded in half). They need to illustrate it and label it with the correct math sentence. Have students use only half of the paper.
9. On the opposite side students will use the same two factors only in the opposite order, creating a new or slightly new picture.

Assessment Suggestions

- Students can write other multiplication sentences in their journal and then write the matching repeated addition sentence.
- In small groups, give each student a different math sentences card, like 6 x 2 or 5 x 3 (make sure each student at the table has a different one, then have the students make that representation of equal groups out of unifix cubes or some kind of manipulative.

Curriculum Extensions/Adaptations/ Integration

- During the assessment with the students building equal groups with manipulatives have students move the equal groups close together to show an array. Use the vocabulary words, vertical and horizontal, to reinforce the meaning of these words while looking at the arrays.
- Students should begin to recognize that some arrays are square and some are rectangles.

Family Connections

- Have students bring an equal group of something from home (e.g., egg cartons, juice box packs etc.).

These items can be labeled with multiplication sentence or repeated addition sentence.

Additional Resources

Books

Things That Come In Groups, by Tierney, Cornelia, Carman, Mary Berle and Akers, Joan. ISBN 0-201-37822-1

Each Orange Had 8 Slices, by Giganti, Paul Jr. ISBN 0-688-13985-X

12 Ways to Get to 11, by Eve Merriam ISBN 0-689-80892-5

Science V-1&3

Activities

Sun: Main Source of Heat

Here Comes the Sun

Standard V:

Students will understand that the sun is the main source of heat and light for living things on Earth.

Objective 1:

Provide evidence that the sun is the source of heat and light for Earth.

Intended Learning Outcomes:

1. Use science and process thinking and skills
2. Manifest scientific attitudes and interests.

Content Connections:

Math IV-2; V-1 measuring-reading a thermometer, writing-journal

Science Standard V

Objective 1

Connections

Background Information

The sun is a star that produces heat and light. The sun has rays that provide the heat and light that is essential for life on Earth. It supports life through photosynthesis in plants, and provides warmth and light. In addition to supporting life on Earth, sunlight is critical to human physical and psychological well-being. The benefits of the sun include keeping Earth's temperatures warm enough to sustain life, providing light, and helping plants grow by providing food.

The sun's energy comes from nuclear reactions in its core. This reaction, called fusion (joining), is produced by the joining of the nuclei of hydrogen atoms forming helium. The byproducts of this reaction are energy (heat and light). The Sun provides heat and light energy (amongst other forms of energy) that are vital for life on Earth. This occurs because heat travels to cooler places.

Our sun (109 times wider than Earth) is an average-sized star and it has been burning for about 4.5 billion years. The sun is a nuclear furnace that is a source of energy that does not pollute. Due to its enormous mass, pressure in the interior of the sun reaches temperatures of almost 16 million degrees C, (28.8 million F). About four million tons of the sun's matter turns into energy every second and only one-billionth of the sun's light ever strikes Earth.

Research Basis

Barton, M. L., & Jordan, D. (2001). *Teaching reading in science.* Aurora, CO: Mid-continent Research for Education and Learning.

Prior knowledge, which is developed and enhanced through science inquiries, is the strongest predictor of student ability to make inferences from text.

Donovan, M. S., Bransford, J. D., & Pellegrino, J. W. (Eds.). (1999). *How people learn: Bridging research and practice.* Washington, DC: National Acadmey Press.

Writing is another way for students to discover, organize, summarize and communicate knowledge. Writing makes thinking processes concrete and increases retention of concepts. The act of writing gives a student access to his or her own thinking processes, enabling the construction of new understanding that is meaningful and applicable. Writing assignments in science have shown to generate reasoning about data.

Invitation to Learn

Begin the lesson by playing the Beatles song, "Here Comes the Sun." Introduce the unit by having the students brainstorm as many words or phases that have the word sun in them. (e.g., sunbeam, Sunday, sundae, suntan, sunburn, sunscreen, Sun Chips, sunlight, sunstroke, Sun Bear, etc.)

Have three paper suns cut out of yellow paper. The three suns will be the KWL chart. In the first sun write down all of the things the students know about the sun. In the second sun write down what the students want to learn. At the end of the unit write down what the students learned in the third sun. Hang the suns in the room and add to them as needed.

Materials

- ❑ Three yellow poster boards
- ❑ *Pocket Temperatures*
- ❑ Strip thermometers
- ❑ Construction paper (red, black, white, blue)
- ❑ Rulers
- ❑ Scissors
- ❑ Glue sticks
- ❑ Large Pringles (one each)
- ❑ Black construction paper
- ❑ Aluminum foil
- ❑ Hammer
- ❑ Nail
- ❑ Wire hanger
- ❑ Bricks or blocks of wood
- ❑ Hot dogs
- ❑ Hot dog buns and condiments
- ❑ "Here Comes the Sun", Beatles

Instructional Procedures:

1. Divide the students into groups.
2. Pass out construction paper, scissors, glue, and rulers to make temperature pockets.
3. Instruct students to measure two 6" x 6" inch squares of each color. Glue three sides together to form a pocket.
4. Review how to read a thermometer.
5. Students place strip thermometers inside the pockets and place all four pockets outside in the sun for the first part of the experiment.
6. Students predict what they think the temperatures will be for each color of pocket.
7. Check the pockets periodically for morning temperatures and for afternoon temperatures.
8. Record temperatures.

- Variations may include placing the pockets in a shaded area and check for temperatures during the following day.

9. Journal the results and compare. Have students journal the steps used to experiment with the pockets and thermometers. (Draw pictures) Did the color of the paper make a difference in the heat recorded? Where was the pocket placed directly in the sun, in a shaded area? Consider questions such as: Which color of paper do you think will heat up the most? And why the students think there is a difference in the temperature.

Hot Dog Cooker

1. Each student will need one large can that still has the lid on it.
2. Place a small nail hole in the middle of the lid and also the bottom of the can.
3. Place the black construction paper around the outside of the can with scotch tape.
4. Straighten a wire hanger.
5. Place the hanger through the holes of the can with about four inches hanging from each end.
6. The cooker is now ready to be used the next day.
7. Place the hotdog on the straightened hanger and push the hotdog to the middle of the hanger, push the wire hanger through the bottom of the can, place tin foil over the opening, and replace the cover of the can.
8. Outside (or in a window in the classroom) place the two ends of the cooker on the bricks/blocks of wood and cook.
9. Take one of the hotdogs out of the can to check temperature. Eat and enjoy.

Assessment Suggestions

Check students' Pocket Temperature page to make sure they are complete and they are filling in the thermometer correctly.

Curriculum Extensions/Adaptations/ Integration

- *Sunburst String Art*-make as a cover for their science journal.
- Have students write a story about A Day Without the Sun.

- Discuss the different temperatures found in ecosystems around the world. What do animals that live in a hot desert do to survive the heat? Does the temperature effect cold-blooded animals differently that warm-blooded animals? How?

Family Connections

- Have the students keep a log of how much time they spend in the sun for a week. Make a prediction and then have them see if they were close.
- Mention in a parent letter that students are learning to measure with thermometers, and ask parents to point out thermometers around the house.

Additional Resources

Videos

The Solar System "A First Look", 100% Educational Videos; ISBN 1-58541-058-6

The Magic School Bus out of this World, Scholastic; ISBN 1-56832-778-1

All About the Sun, Schlessinger Science Library, www.libraryvideo.com

Web sites

http://www.sciencelink.com

http://www.ajkids.com/searchheat,light,sun

Pocket Temperatures

Which color of paper do you think will attract more heat?_____

Which color of paper do you think will attract less heat?_____

Record the temperature to the nearest 10 degrees for each pocket and color in the thermometer for each.

Red Pocket	Black Pocket	White Pocket	Blue Pocket
Prediction _____	Prediction _____	Prediction _____	Prediction _____
Actual _____	Actual _____	Actual _____	Actual _____

I found out that _____

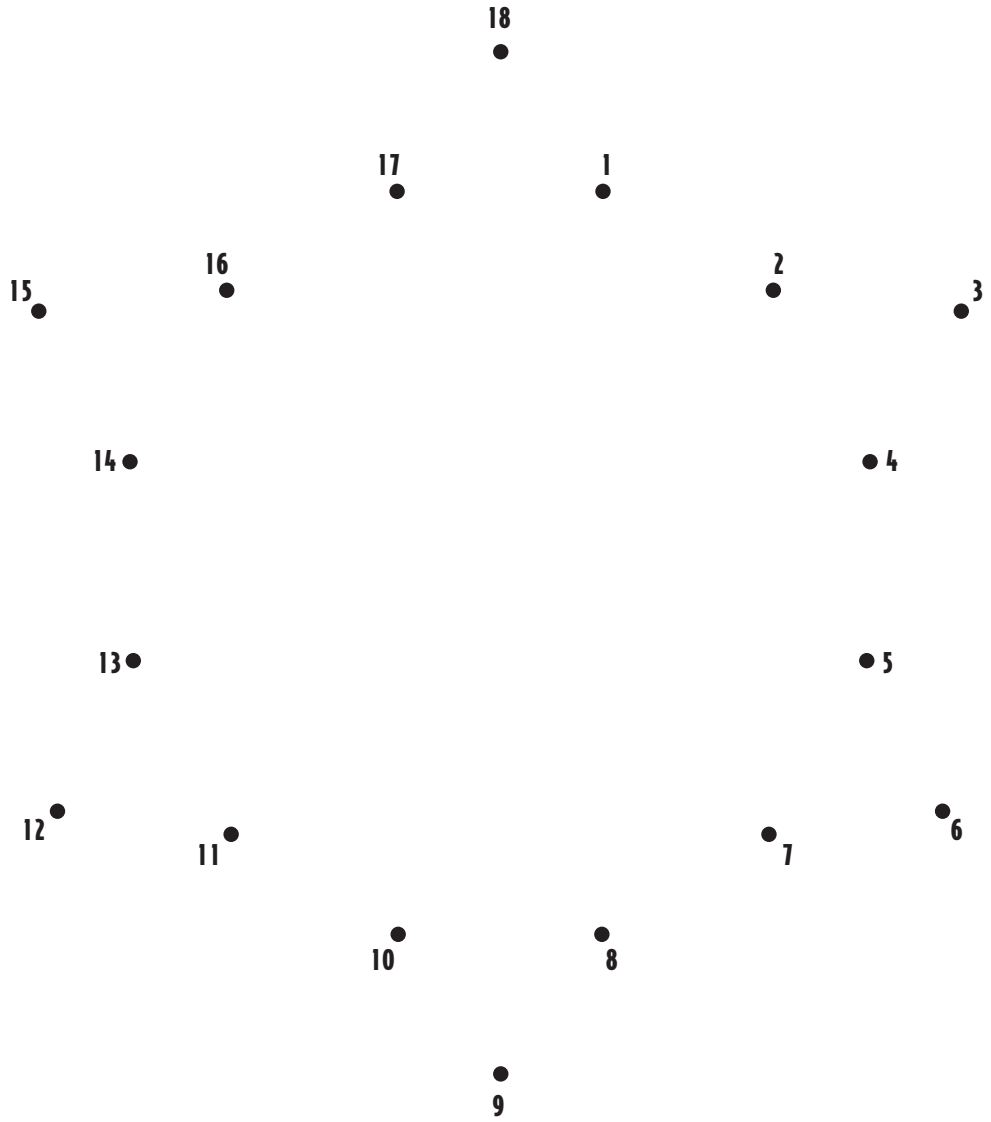
Why do you think there was a difference in temperature?_____

_____

What do you think the temperatures will be if you put the pockets in the shade?_____

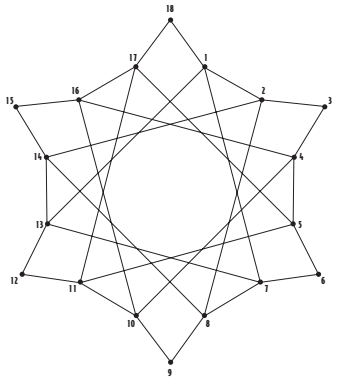
_____

Sunburst String Art



From	To
1	7
5	11
10	16
14	2
4	10
8	14
13	1
17	5
7	13
11	17
16	4
2	8
10	9
8	9
7	6
5	6
4	3
2	3
1	18
17	18
16	15
14	15
13	12
11	12
11	10
8	7
5	4
2	1
17	16
14	13

Completed sample:



Sunlight Necklaces

Standard V:

Students will understand that the sun is the main source of heat and light for living things on Earth.

Objective 1:

Provide evidence that the sun is the source of heat and light for Earth.

Intended Learning Outcomes:

1. Use science and process thinking and skills
2. Manifest scientific attitudes and interests.

Content Connections:

Math I-2,5 number order

Science Standard V

Objective 1

Connections

Background Information

The embryo inside a seed is "asleep" until it germinates. Some seeds are dormant and will only become active after a certain environmental occurrence, such as fire, a certain length of time chilled, or light. The seed first takes in a lot of water, which causes it to expand and break the seed coat as well as signaling the embryo to start to grow again.

In a developing corn or wheat seedling (monocots), the epicotyl give rise to the stem and leaves, while the hypocotyl and radicle give rise to the roots. The embryo is partially surrounded by endosperm. The cotyledon stores food.

In the developing bean seedling (dicots), the epicotyl gives rise to the terminal bud, the leaves, and the upper part of the stem. The hypocotyl gives rise to the lower part of the stem and the radicle gives rise to the roots.

Research Basis

Bransford, J.D., Brown, A.L., & Cocking, R.R., (Eds.). How people learn: Brain, mind, experience, and school. *Science ed.*, p. 20

The persistence and curiosity of children are sustained by adults who direct their attention, structure their experiences, support their learning attempts, and adjust the complexity and levels of difficulty of information for them.

National Research Council. (1996). National science education standards. *Science ed.*,p. 82

A solid foundation in scientific inquiry strengthens many of the skill that people use daily, such as creatively solving problems, thinking critically, working cooperatively in groups, effectively using technology, and valuing life-long learning.

Materials

- ❏ Microcentrifuge tubes
- ❏ *Observing Sunlight Necklaces*
- ❏ Opaque film canister
- ❏ Radish seeds
- ❏ Potting soil
- ❏ UV beads
- ❏ Assorted sun screen/ lotion
- ❏ Petrie dishes
- ❏ Chenille stems

Invitation to Learn

Hand out two UV beads per student. Do not tell them what they are, but ask students to make observations about them. Tell students to make a bracelet for these, and they can wear them all day while making observations.

Instructional Procedures:

Sunlight Necklaces

1. In the lid of the canister, with a pen, place a small X in the middle of the lid. With a drill place a hole and make the hole large enough so the microcentrifuge fits in the hole, because when the student is not wearing the necklace it will stay in the canister stand.
2. Now that the stand has been completed place it to the side. Fill the microcentrifuge tube with moist potting soil or a moist cotton ball. Fill the tube being careful not to pack the soil down otherwise the roots will not a have a chance to grow.
3. Now that the soil is in the tube take a very sharpened pencil and make a depression in the soil about 0.25 cm deep. Drop one of two seeds into the depression and cover the seeds up being careful not to pack the soil down. Place the tube into the holder.
4. Cut a string about 18 inches long to put through the hinges so the microcentrifuge can be worn around the neck.
5. Walk around the school and make observations of all the plants that need sunlight. (Students will notice right away that their bracelets change colors.) When you go back into the classroom discuss what happen and why.
6. Use a picture journal daily, to track the progress of the plants in the sun and the plants that will be left in the shade.
7. Discuss ways that we protect ourselves from the harmful rays of the sun.

UV Beads

1. Divide class into groups.
2. Pass out Petrie dishes, three beads, and sun screen/lotion.
3. Put various sun screen products on the beads and place in Petrie dish. Label Petrie dish lid with sun screen type and SPF.

4. Go outside and observe what happened to the beads. Have students record in their journals what they learned.

Assessment Suggestions

- Students draw daily pictures of their Sunlight necklaces in their science journal.
- Inquiry questions – Are there going to be roothairs? Where is the plant going to come out?

Curriculum Extensions/Adaptations/ Integration

- Place one of the living necklaces inside a cupboard and observe what happens over time.
- Give one living necklace more water and observe what happens over time.
- Cover one living necklace with black paper and observe what happens overtime.
- Write a cinquain poem about a plant, a sunflower, or sun. A cinquain is an unrhymed poem that is five lines long with each line having a specific pattern. A cinquain is a form of free verse, which means that the lines of the poem do not have to rhyme. Follow the directions below to write a cinquain poem.
  Line 1 is a one-word subject or topic.
  Line 2 has two adjectives (describing words).
  Line 3 contains three verbs (action words) usually ending in "ing"
  Line 4 is a four-word phrase giving your personal reaction to the subject (how you feel about it).
  Line 5 has a one-word synonym (word that means almost the same thing) for the subject.
- Brainstorm and make a list of adjectives, "ing" words, and synonyms for the words you are planning on using. This will assist students in writing their own poems.
- Play or sing "Sunlight" by Annette Van Wagenen, Core Academy 2003.
- What have we recorded in our journals about the heat and light concept? Do the journals indicate awareness of the lessons taught?

Who, What, Where, When, Why poem
Who – The Sun
What – Is giving heat and light
Where – To the Earth
When – Everyday
Why – Because…

Family Connections

- Have student collect data on the number of living plants that are in their home. Estimate how much light each plant receives and discuss if some plants need more light than others.
- Students share their Sunlight Necklaces with their families.
- Students share their UV bracelets with their families.
- Observe how sunlight effects plant growth around the house.

Additional Resources

Books

How a Seed Grows, Helen J. Jordan; ISBN 0-06-445107-0

From Seed to Plant, Gail Gibbons; ISBN 0-8234-1025-0

Science Saurus, A Student Handbook, ISBN 0-669-48192-0

Ed Thoughts, What We Know About Science Teaching and Learning

Videos

How Seeds Get Here...and There, MBG Videos

What's Inside a Seed?, Coronet, The Multimedia Co.

Articles

Problem Solver, Garry R. Hardy and Marvin N. Tolman, Department of Elementary Education, Brigham Young University, Provo, UT.

Web sites

National Teacher Enhancement Project, "Solar Ovens"

http://www.ed.final.gov/ntep/f98/projects/nrel_energy_2/solarovens.htm

www.icangarden.com/kidz.htm

www.arborday.net/kids/kid_links.htm

Organizations

Living Necklace Kits, 1-435-797-0765,www.agclassroom.org/ut

UV Beads, Bolek's Craft Supply, Inc. 1-800-743-2723, www.bolekscrafts.com

Observing Sunlight Necklaces

Necklace Placed in Cupboard			
	Color	Measurement	Observation
Day _____			
Day _____			
Day _____			
Day _____			

Necklace Wrapped in Paper			
	Color	Measurement	Observation
Day _____			
Day _____			
Day _____			
Day _____			

Necklace Given Extra Water			
	Color	Measurement	Observation
Day _____			
Day _____			
Day _____			
Day _____			

Math IV-1&2

Activities

Measurement

Measurement: Length, Capacity, and Time

Standard IV:
Students will understand and use measurement tools and techniques.

Objective 2:
Use appropriate techniques and tools to determine measurements.

Intended Learning Outcomes:
1. Make mathematical connections.
2. Communicate mathematically.

Content Connections:
Measurement, Measurement, Measurement!

Math Standard IV

Objective 2

Background Information

A measurement always has two parts: a number and a unit. Standard units include: inches, feet, yards, centimeters, meters, teaspoons, cups, gallons, pounds, minutes, etc. Nonstandard units include: paper clips, bricks, frogs, marbles, pencils, toes, etc.

In different parts of the world at different times, there have been many systems of measurement. In the past, people often used one man's cubit or steps as a standard. That man was usually the people's leader or king. Kings would not travel from house to house to measure things, so standard measuring sticks were made (refer to the book, *Millions to Measure*, under additional resources).

Today only two systems are widely used. The customary, or inch-pound, system is used in the United States. The term "customary" refers to what is used or is "customary" in your area. So "customary" in the United States is the inch-pound system, while the "customary" system in Europe would be the metric system. The metric system is used in most other counties.

Research Basis

Cain-Caston, M. (1996). Manipulative Queen. *Journal of instructional psychology*, Volume 23.4, p 270.

Mulrvan, C. (1995). Involvement and participation in cooperative small groups in mathematics. *Elementary school journal*. Volume 95.4 p. 297.

Students do not fully understand math concepts if they cannot relate it to something in their own experiences. The use of manipulatives and a hands-on learning technique help make mathematics a pleasure rather than a chore. Students understand mathematics and have greater gains when mainpulatives are used.

Connections

Materials

- ❑ *Twelve Snails to One Lizard*
- ❑ Rulers and/or measurement tapes
- ❑ Butcher paper
- ❑ Pencils
- ❑ Crayons
- ❑ Scissors
- ❑ *My Other Self*
- ❑ Math journals
- ❑ *Me and the Measure of Things*
- ❑ Pictorial representations of the units of capacity
- ❑ Teaspoon, tablespoon, cup, pint, quart, gallon
- ❑ Containers, cups
- ❑ Large containers of water
- ❑ *Container Capacity*
- ❑ *Capacity Bingo*
- ❑ *Capacity Bingo Clues*
- ❑ *Me Counting Time*
- ❑ Adding machine tape

Students are more active learners and are more motivated when they work in cooperative groups.

Invitation to Learn

Read and share the book *Twelve Snails to One Lizard* by Susan Hightower.

Ask the children to visualize how difficult it would be to have to use non-standard units of measurement to measure things.

Instructional Procedures

After reading the book and sharing the need for a standard unit of measurement, pass out rulers to the class. Go over the attributes of a foot. Show the students that a foot has 12 inches. Show the students the markings on the ruler for inches, half inches, and quarter inches. Show the students a yardstick. Go over the attributes of a yard. Show the students that a yard is made up of three feet or 36 inches.

1. Pass out large pieces of butcher paper. Inform them that they are going to make a model of their own body.
2. Break the students into partner groups. Have the students take turns lying on their own piece of butcher paper, and tracing their partner on paper.
3. After the tracings are complete, have the students draw in their own features (their faces, their clothing, the details of their hands, etc.)
4. After the students are drawn, have them cut out their "self."
5. Explain that their "other self" is not an exact measurement of their body. The outline would actually be larger than their exact body, and also, the person tracing them might not have been exact at all times.
6. Give each student a blackline master entitled *My Other Self*.
7. Have the students measure the different parts of their "other self" that are listed on their paper.
8. Make up some interesting awards for the "longest legs," the "longest fingers," etc. Be careful to make sure the awards could not be used in a derogatory manner.
9. As an extension, hand out copies of *My Other Self*, and have the students pick out a nonstandard unit to measure themselves with. Students could use paperclips, crayons, etc. Make sure

the students list the number and unit (e.g., my "other self's" arm is 22 crayons long.)

10. Hang these lifelike "students" in the hall before parent teacher conference for the parents to view. Students could also cut out another copy of their body, staple the two together and stuff to place at their desk before their parents come to conference.

Assessment Suggestions

- Have the students turn in their individual papers with body measurements on them. You could check one or two attributes to make sure they are correct.
- Journal entry - Have the students create their own alternatives to use in place of an inch, a foot, and a yard that they could use as suggestions to the beaver. Then have the students tell what complications the beaver might encounter as he tried to use your suggestions.
- Journal entry - Use the copy of the journal entry of the boy or girl on the blackline master. Have the students record any surprises they might have encountered while measuring their other "self."

Invitation to Learn

Read and share the book *Me and the Measure of Things* by Joan Sweeney.

Instructional Procedures

Remind the students that in measurement, we always have a number and a unit. Review some of the measurement units we use. (e.g., feet, inches, yards, miles, meters, etc.)

1. Discuss times when students would need to measure "capacity." Review that capacity is the amount that something can hold.
2. List on the board the following customary measurement units.

   1 Cup=16 Tablespoons=8 ounces

   1 Quart=2 pints=4 cups=32 ounces
3. As each word is introduced on the board, show an example of each word (e.g., After writing cup on the board, show the students a cup and also the graphic of a cup).

4. Explain to the students that a cup and a quart can also be made up of other customary measurement units. Show the students a half-pint carton (the kind they get with their lunch tray), and explain that half of a pint is equal to a cup. Explain to the students that four quarts equal a gallon, like the gallon of milk they buy from the grocery store. Write the following measurements on the board and show the graphics and real examples of each. (Note: cups and quarts are the only two measurement units for capacity listed in the Core Curriculum.)

   Teaspoon

   Tablespoon=3 teaspoons

   Pint=2 cups=16 ounces

   Gallon=4 quarts=128 ounces

5. Split your class into small groups. Provide each group with an assortment of containers and cups. Have the students estimate the number of cups needed to fill each container. Have the students record their estimates on the blackline handout, *Container Capacity.*
6. Pass out large containers of water. Have the groups then record how many cups it actually took to fill each large container.
7. Monitor the class as they work in their groups. Make sure each child is contributing to his/her group's discussion.
8. Have the small groups record their findings on the blackline handout, *Container Capacity*.
9. Have the students order their containers from smallest to largest.

Assessment Suggestions

- Have the students turn in their group's blackline handout, *Container Capacity*.
- As a class, generate examples of two or three riddles you could write about units of capacity. (e.g., I am made up of two cups and equal 16 ounces. What unit am I? Answer: A pint) Have the students write at least two of their own riddles. Put the students in partner groups, and have them exchange their riddles and answer them. Have the students turn in their answered riddles.
- Journal entry - Have the students write a short paragraph describing their small group's work. Have them list any

surprises or correct assumptions they had in their work. You could ask them to list two "Ah-Has" they experienced, and one question they have.

- After reviewing the units of capacity repeatedly, have the students play "*Capacity Bingo*". Copy a blackline master of *Capacity Bingo* on cardstock for each student. List the words: teaspoon, tablespoon, cup, pint, quart, gallon, eight ounces, two cups, two pints, and four quarts on the board. Have the students pick nine of these words to write in individual boxes on their bingo paper. Tell them to mix them up! Using the blackline master *Capacity Bingo Clues*, cut the clues out and mix up for use during the play of bingo. Read a clue to the class and have them place a marker on the correct answer. As an extra challenge, when someone gets bingo, you could make the student read back their square that was covered, and then have them recall the clue it matched. (e.g., Cup: It is made up of eight ounces.)

Invitation to Learn

Read and share the book *Me Counting Time* by Joan Sweeney.

Instructional Procedures

1. Ask the students to think about measurement. Review the units of measurement that have already been discussed (e.g., inches, feet, yards, teaspoons, tablespoons, cups, pints, quarts, gallons). Ask if they ever considered that time is a measurement.
2. Have the students brainstorm a list of units of measurement that we use when measuring time. They can refer back to the book *Me Counting Time*.
3. Pass out a piece of adding machine tape to each student in your class. They should get a strip of tape that correlates with how old they are. If they are nine, they get nine feet of adding machine tape.
4. Have the students use a ruler and make a mark on their tape where each foot occurs. Have them write on the first foot mark the year they turned one-year-old, the next mark would have the next year, etc.
5. After they have written in the years on their timeline, have them now mark off in inch increments each foot. Each of the inch

increments will be labeled with a month (the first inch January, the second inch February, etc.).

6. Monitor the class as they work on their timelines, helping to make sure their measurements are accurate (you might want to use some parent volunteers during this activity).
7. Remind the students of the timelines you have already seen and used in social studies.
8. Help the students brainstorm any events they might be able to include on their timeline. You could include things that have happened during the school year (e.g., in September the class went on a field trip to the fire station, etc.). If they have recollections of the age their parents told them they first walked, they could include that on their timeline. If their family went on a vacation last June to Disneyland, they could include that on their timeline. The possibilities are endless!
9. You can send home this timeline as a homework assignment, and have the parents help their child come up with more things they could include on their timeline.
10. Display the timelines as they are returned to class.

Assessment Suggestions

- Have the students share their timelines with the class. They could discuss the major events of their timeline. If this is too lengthy, you could have them share five or six events each.
- Using a clock stamp, make up your own worksheet. In centers or as a class, put times on the board using word format (e.g., a quarter after three) and then have the students put in the hands on the clocks and the numbers on the digital clock.
- Gather three small bells (the smaller the better). Pick four children to be the timekeepers of the day. Each child gets to be in charge of a bell. One student is in charge of the hour, one the half hour, one the quarter hour, and one the quarter to hour. Their job is to ring their bell to let the class know which time is occurring.
- Using the stamp of the clock, assign times out to individual students, or to pairs. Have the students draw in the time assigned, and then illustrate what they are doing at that time of the day. Put the pages in order and bind as a class book.

- End of the unit assessment - Use the cards entitled *I Have Who Has* to review quickly the units of measurement that have been covered.

Curriculum Extensions/Adaptations/ Integration

- ELL Connections - the use of pictures showing representations of the units for capacity (cup, quart, etc.) and the use of real life objects showing an example of each of these units.
- Math/Length/Graphing - Split your class into small groups. Give each group a spool of ribbon or a ball of yarn. Have each child cut a length of yarn or ribbon the size of their wrist. Make a class pile of wrist pieces. Have each child cut a length of yarn or ribbon the size of their ankle. Make a class pile of ankle pieces. Have each child cut a length of ribbon or yarn the length of their neck, etc. After collecting the piles, tape the lengths to a graph on butcher paper. Have one section of your graph for wrists, one for ankles, one for necks, etc. You could also have the students find something in the room that is close in measurement to their string piece and record the findings in their math journals before adding them to the piles.
- Art - Measure out one meter of string with the meter stick. Cut off the string. Spend a few moments talking about meters. "Are you taller or shorter than one meter? What can you think of that's about one meter wide? Do you know any other measurement words that contain the word meter?" Lay the string on your construction paper. Move the sting around to create a picture. You must use the whole length of string in your picture. After you have decided on a picture, glue your string down in that shape. Display the pictures together so that everyone can see how many different ways a line of the same length can appear.
- Penmanship - Use the same above concept mentioned for art, but instead of any design, have the students create their name in cursive with the meter of string.
- P.E. - Purchase a 'design your own parachute'. Paint on the blank parachute the numbers of a clock face. For P.E., split your class in pairs. Give each pair a time (e.g., 3:30), and have the pairs each show their time on the parachute with their bodies. You might want to avoid times like quarter after three, so that the students do not have to lie on each other!

- Center or Bulletin board idea - Watch the time! A giant wristwatch is made for the bulletin board with movable hands attached with a paper fastener. Write your own class schedule on sentence strips and let the children move the hands to show what's happening next.
- Center or Bulletin board idea - Measure the circumference of the students' heads with different colored yarn, ribbon, or other material. Cut the "snake" to size. Let the students decorate with eyes, tongue, etc. Display the snakes on a table in a center, or on a bulletin board. Let the students measure items in the classroom with their "snakes" to find things the same size, things longer, and things shorter.
- Social Studies - Have the students construct a timeline of their early childhood as a homework assignment. They could include their date of birth, when they crawled, when they walked, their first tooth, etc.
- Social Studies & Science - Explain to the students: "Because Earth turns, it is daytime in part of the world when it is nighttime on the other side of the world. In 1884, delegates from 25 countries met and agreed to divide the world into time zones. If you draw a line around the middle of the Earth, it is a circle (equator). The delegates divided the 360 degrees of the circle into 24 zones, each 15 degrees (24 x 15=360). They decided to start counting from Greenwich (pronounced GREN-ich), England, which is 0 degrees longitude. In the continental Untied States, there are four time zones: Eastern, Central, Mountain, and Pacific. Each time zone varies by one hour, so when it is 7 p.m. in the Eastern time zone, it is 6 p.m. in the Central time zone, 5 p.m. in the Mountain time zone, and 4 p.m. in the Pacific time zone" (www.arcytech.org/java/clock/clock_history.html). After explaining these concepts, and showing the children a map of the world, make up some of your own problems. Give the students a map of the U.S., and have them convert times. (e.g., If it is 3 p.m. in New York, what time is it in Utah?)
- Art - List the months of the year on chart paper and have the students brainstorm their favorite activities for each month. Split your class into teams assigning each team a month. Give the teams a copy of a blank calendar page to fill in the dates and illustrate. Bind the pages to make a class calendar.
- Art - Give the students each a strip of adding machine tape (either one yard or meter in length—depending on if you are

discussing the customary or metric system at this time). Have the students complete a timeline for their day on the strip.

- Science - Measure time using sundials.

Family Connections

- Make up your own homework assignment ditto asking students and parents to find objects in their home or neighborhood that are a specific length. (e.g., What three items can you find in your home or neighborhood that are approximately one foot in length each?)
- Send home a homework assignment to have the child be responsible to let the parents know when a predetermined event will take place. For example, the child knows their bedtime is at 9:00 and supper is at 6:00. They are to watch the clock and tell their parents when supper should be taking place, or when it is time for bed.
- Ask the parent to let their child be the 'measurement expert' for dinner one night during the week. Their child would be responsible for measuring out any ingredients that are to be used in that night's meal.
- Send home a note to parents asking them to let their child go to the grocery store with them during the week. Have the child record weights of any produce that is purchased. They could also record weights for meat purchases, or any boxed items that list their weight on the packaging.

Additional Resources

Books

How Big is a Foot?, by Rolf Myller; ISBN 0-440-40495-9

Twelve Snails to One Lizard, by Susan Hightower; ISBN 0-689-80452-0

Me and the Measure of Things, by Joan Sweeney; ISBN 0-440-41756-2

Me Counting Time, by Joan Sweeney; ISBN 0-440-41751-1

Counting on Fank, by Rod Clement; ISBN 0-395-70393-x

Measuring Penny, by Loreen Leedy; ISBN 0-8050-6572-5

Inch by Inch, by Leo Lionni; ISBN 0-688-13283-9

Inchworm and a Half, by Elinor J. Pinczes; ISBN 0-618-31101-7

If You Hopped Like a Frog, by David M. Schwartz ISBN 0-590-09857-8

Jim and the Beanstalk, by Raymond Briggs; ISBN 0-698-11577-5

How Tall How Short How Faraway, by David A. Adler; ISBN 0-8234-1632-1

Hershey's Mile Chocolate Weights and Measures, by Jerry Pallotta; ISBN 0-439-38877-5

Bats Around the Clock, by Kathi Appelt ISBN 0-688-16469-2

Telling Time with Big Mama Cat, by Dan Harper ISBN 0-152-17380

Something Furry in fhe Garage at 6:30 A.M., by Betsy Franco

Millions to Measure, by David M. Schwartz; ISBN 0-688-12916-1

Videos

How Long? How Far? Availabe from Media House Publications, Regina, SK. (Catalogue No. V981) Suitable for Grades 3-7.

How Much Does It Hold? Available from Media House Publications, Regina, SK. (Catalogue No. V9820). Suitable for Grades 3-7.

Web sites

http://www.arcytech.org/java/clock/telling_time.html

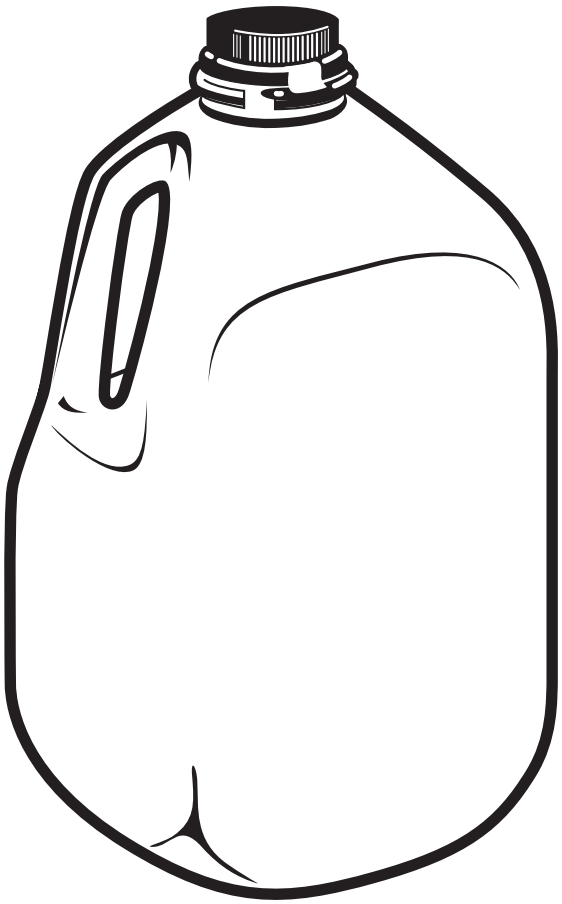
http://www.aresearchguide.com/time.html#lesson

Additional Media

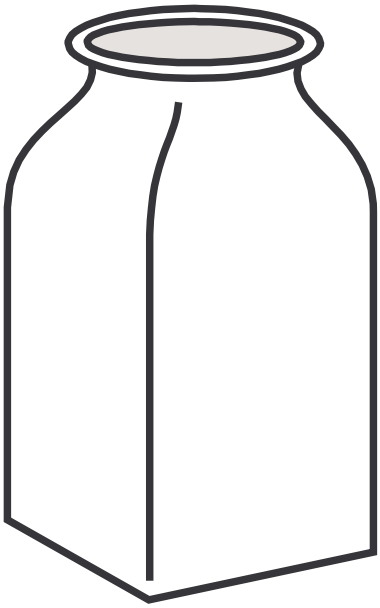
Timetown CD –Rom. Steck-Vaughn Interactive Learning. Suitable for K-6

Cyber Chase television program on the educational channels. (Many episodes on weight, capacity, perimeter and area.)

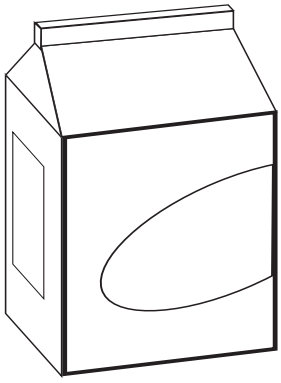
Units of Capacity



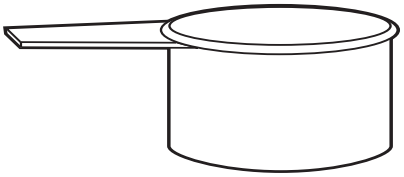
Gallon



Quart



Pint



Cup

Tablespoon

Teaspoon

Name _____

My Other "Self"

My other self's leg is _____ _____long.

My other self's hand is _____ _____long.

My other self's head is _____ _____long
from the top to its chin.

My other self's arm is _____ _____long.

My other self's whole body is _____ _____long.

My other self's shoulders are _____ _____apart.

Name _____

My Other "Self"

My other self's leg is _____ _____long.

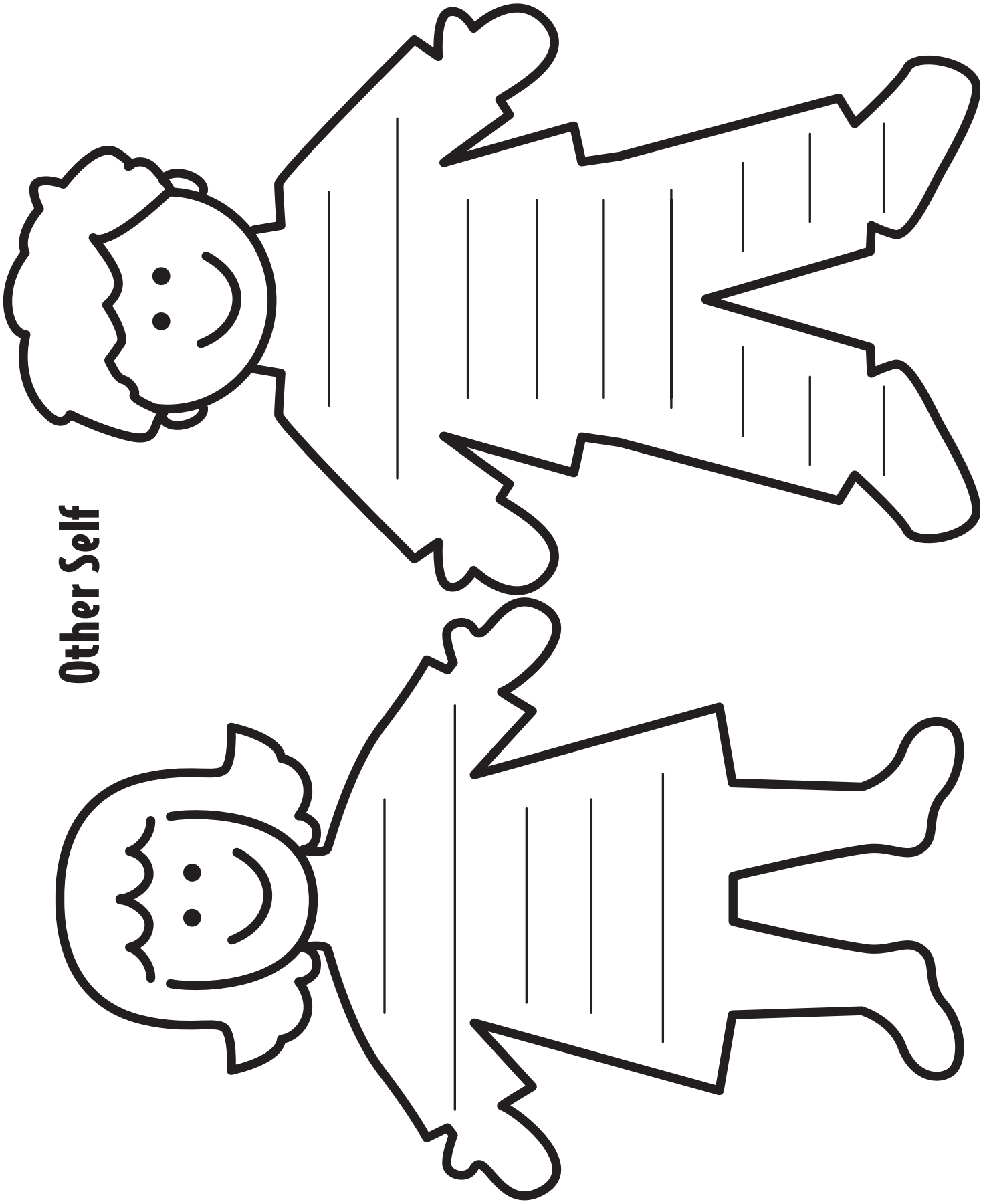
My other self's hand is _____ _____long.

My other self's head is _____ _____long
from the top to its chin.

My other self's arm is _____ _____long.

My other self's whole body is _____ _____long.

My other self's shoulders are _____ _____apart.

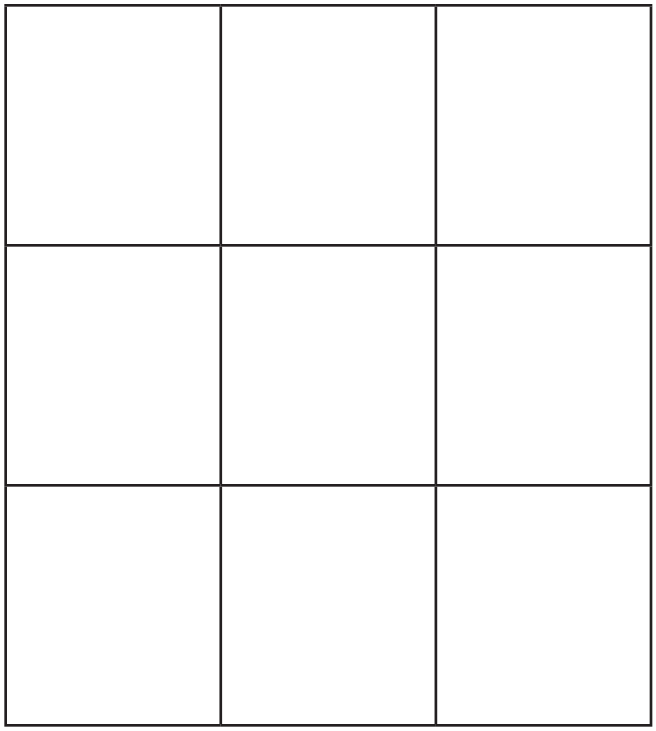

Other Self

Container Capacity

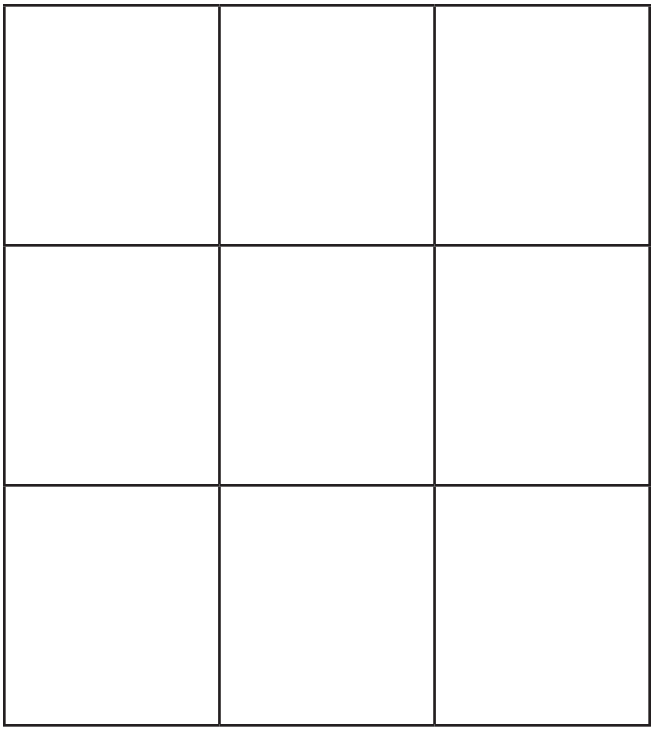
Names of members of the group: _____

Container #1 Description of container: Estimate _____How many cups? Actual capacity _____	**Container #2** Description of container: Estimate _____How many cups? Actual capacity _____
Container #3 Description of container: Estimate _____How many cups? Actual capacity _____	**Container #4** Description of container: Estimate _____How many cups? Actual capacity _____

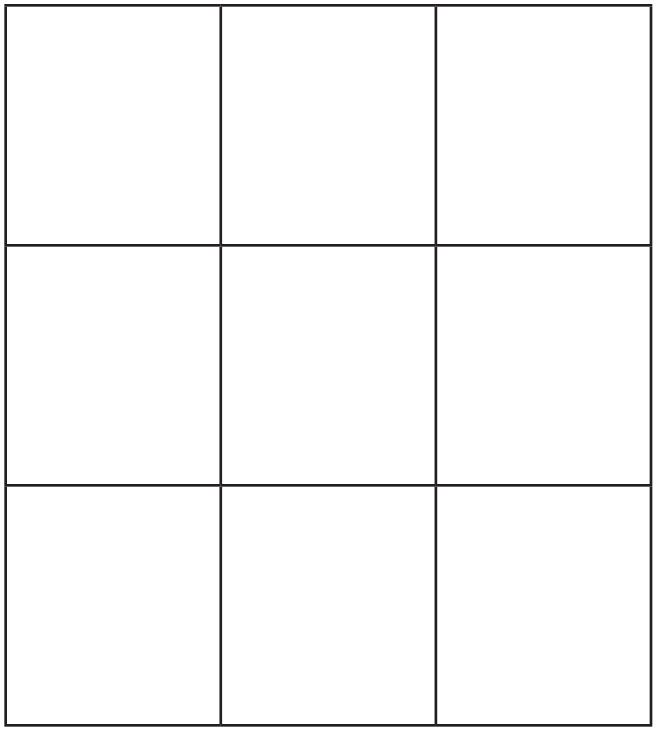
Capacity Bingo



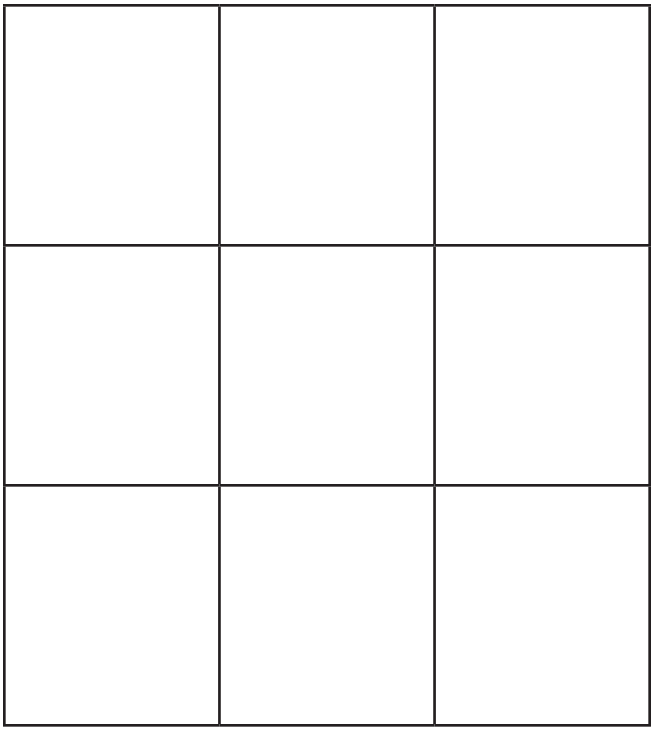
Capacity Bingo



Capacity Bingo



Capacity Bingo



Capacity Bingo Clues

Cut out the following cards and mix them up to draw.

It takes 3 to make this. (Teaspoon)	I am equal to 1 pint. (2 cups)
I am equal to 3 teaspoons. (Tablespoon)	I am equal to 2 pints. (Quart)
I am equal to 8 ounces. (Cup)	I am equal to 1 quart. (2 pints)
I equal 1 cup. (8 ounces)	I am equal to 4 quarts. (Gallon)
I am equal to 2 cups. (Pint)	I am equal to 1 gallon. (4 quarts)

I Have Who Has Game Cards

I have 1 teaspoon. Who has 12 inches?	I have 1 pound. Who has 100 centimeters?
I have 1 foot. Who has half past 3?	I have 1 meter. Who has the time between midnight and noon?
I have 3:30. Who has 4 quarters?	I have a.m. Who has 2 dimes and 1 nickel?
I have 1 dollar. Who has 2 cups?	I have 1 quarter. Who has ten years?
I have 1 pint. Who has 24 hours?	I have 1 decade. Who has 10 cents?
I have 1 day. Who has 5 pennies?	I have 1 dime. Who has quarter to two?
I have 1 nickel. Who has 16 ounces in weight?	I have 1:45. Who has the temperature at which water freezes?

I Have Who Has Game Cards

(Begin) I have 32 degrees Fahrenheit or 0 degrees Celsius. Who has 3 feet?	I have 1 month. Who has 1/12 of one foot?
I have 1 yard. Who has 60 minutes?	I have 1 inch. Who has 2 pints?
I have 1 hour. Who has 8 ounces?	I have 1 quart. Who has 7 days?
I have 1 cup. Who has 365 days?	I have 1 week. Who has a non-standard unit of measurement?
I have 1 year. Who has 60 seconds?	I have a lizard. Who has the number of hours in a day?
I have 1 minute. Who has 3 teaspoons?	I have 24. Who has 4 quarts?
I have 1 Tablespoon. Who has 1/12 of a year?	I have 1 gallon. Who has 1/3 of a Tablespoon?

Science II-1&2

Activities

Living/Non Living

What it is, What it isn't

Standard II:

Students will understand that organisms depend on living and nonliving things within their environment.

Objective 1:

Classify living and nonliving things in an environment.

Intended Learning Outcomes:

1. Use Scientific Process and Thinking Skills.
3. Understand Science Concepts and Principles.

Content Connections:

Math V – 1 Collect, organize, and display data.
Language Arts VII – Identify different structures in text
Language Arts IIX - Students write daily to communicate effectively

Science Standard II

Objective 1

Connections

Background Information

Sorting is a common procedure in classification. Science has often used visual sorting as a system to first classify items in order to understand how they work the way they do. Students will be visually sorting and looking for common characteristics and differences starting with dry beans. This activity will aid the students to look for details in each bean and then transfer this type of sorting to recognize characteristics of living and nonliving items within an environment.

Research Basis

Newton, L.D. (June 2002). Questions that help children understand Elementary Science. *Investigating*, Volume 18 (Issue 2), Page 6-9

It is vital to any lesson taught that the learner comes away having learned the concept. Many teachers ask questions as a form of assessment and to guide them in how the lesson should proceed. Teachers need to ask the "right questions" to make a difference. Some questions are interesting, but are they worthwhile? If carefully tailored, questions can be a very effective strategy.

Invitation to Learn

The instructor will write on chalkboard or put up word strips, "Living" & "Nonliving." The instructor will also have picture cards of approximately 12 to 15 items. Instructor asks, "Can you students help to visually identify these items and place them into two groups? One group are living things, the second group are nonliving things. Where should I place this example?"

Materials

- ❑ Twelve to fifteen living and nonliving cards
- ❑ *Let's Classify*
- ❑ Ten to fifteen varieties of dry beans
- ❑ *C.S.I. Mystery #1 & 2*
- ❑ Overhead projector
- ❑ Overhead sheet picture

Instructional Procedures

1. Discuss "Who knows about living organisms? Can we identify living things by certain characteristics? What characteristics were you using to place the cards? Where would we place items such as a fire or a dead log?"
2. Ask students to suggest the characteristics of a living organism. Does it breathe, eat, move and reproduce? These are the main characteristics to write on the board.
3. Journals – Make a "t" chart in your journal. Show an example of chart on the board. Instruct students to list on one side "Living" and on the other, "Nonliving." Ask students to visualize and list five items from the schoolyard for each side of the "t". When finished, ask students to share one or two examples. The teacher could make a "t" chart on the board and list students' suggestions. Students could check their own journal work for correctness.
4. Give each student a copy of the Let's Classify worksheet and instruct him or her to look at each individual picture and respond to the question for each column.
5. Place students into groups. Give each group a bag of beans and hand out the C.S.I. Mystery #1 page to be filled out by the group. Instruct students to compare, sort, and identify each bean and to fill out and complete the worksheet. Once completed, discuss in whole group their findings and list on the board some of the identifiers that were thought up. Collect pages to use as an assessment. Collect bag of beans.
6. Journals – "How do you think we might apply our findings to compare, sort, and identify items in an environment?"
7. Instructor shows overhead picture and asks, "Can we classify items shown in this picture into living and nonliving things?" Hand out C.S.I. Mystery #2 page and instruct students to complete this page individually.

Assessment Suggestions

- Journal entries may be used.
- Completed worksheets may be used.
- Verbal responses: Allow students to work in teams. Take them outside and ask them to show the instructor an example of a

living thing and a nonliving thing. What did they use to help them classify?

Curriculum Extensions/Adaptations/ Integration

- Students can look around the room and/or school. How many items can the find and list that are living and nonliving?
- Journal entries– Students can write a sentence in a simile form. Example: The rocks outside have shiny specs in them, like small stars. This would be a written form of comparing a small environment to a large one.
- Students can be given a magazine and asked to find a picture that has examples of living and nonliving items showing. Students can list said items.

Family Connections

- Students can make a list from home of items living and nonliving in their house, apartment, yard, or neighborhood playground.
- Students can share the living criteria with family members on what makes an item living things.

Additional Resources

Books

Take Another Look, by Tana Hoban; 0-688-80298-2

Look Again! By Tana Hoban; 0-02-744050-8

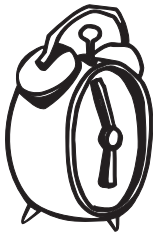
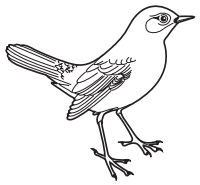
Just Look by Tana Hoban; 0-688-14041-6 LE

Web sites

http://www.labschool.org

Name _____

Let's Classify – Living and Nonliving

Object	Does it breathe?	Does it eat?	Does it move?	Does it Reproduce?	Living?
					
					
					
					
					

Name _____

C.S.I. Mystery: Compare, Sort & Identify #1

Look at this bag of beans. Look carefully! Compare each bean to the other. Now sort them and identify how they are the same and how they are different. Write down all of the different ways you can identify and sort.

Compare two beans. Draw the shape, one bean in each square. Describe how the two beans are the same.

Draw	Draw
Describe	Describe

Name _____

C.S.I. Mystery: Compare, Sort & Identify #2

Look at this picture. Look carefully! Compare each tree to the other, each bush to another. Are there different size rocks with different textures? Now sort them and identify how they are the same and how they are different. Write down all of the different ways you can sort. How many different things can YOU identify and list?

Compare two things from the picture. One must be a living thing, the other a nonliving thing.

Draw or Describe	Draw or Describe

Journal entry: Respond to each question.
How is each item you have identified needed in the environment pictured here? What would happen if all the living things were removed?

What's in the dirt?

Standard I:

Students will understand that organisms depend on living and nonliving things within their environment.

Objective 2:

Describe the interactions between living and nonliving things in a small environment.

Intended Learning Outcomes:

1. Use science process and thinking skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles

Content Connections:

Identify, predict and observe
Make simple predictions and inferences based upon observations
Lang. Arts 8 – 1 Prepare to write by gathering and organizing information and ideas
Math V – 1 Collect, organize, and display data to make predictions.

Science Standard I

Objective 3

Connections

Background Information

Slight changes in an environment can bring about large changes to a living organism. Organisms that live in the soil like the environment to be cool, dark and moist. Using a Berlese (pronounced "bur LAY zee") funnel, we can add heat and light to the topsoil, thus drying out the sample and forcing the organisms to escape this change. Students do understand that with a change of seasons, their own environment is affected. How can this same principle be applied to other living organisms? This simple experiment will provide an observable change in a small environment.

Research Basis

Shaw, E.L. Jar, Baggett, P.V., Daughenbaugh, L.R., Daughenbaugh R.L., & Santoli, S. (2005) from boxed lunch to learning boxes: an interdisciplinary approach. ***Science activities***, (Fall), pp. 16-25.

Newton, L.D. (June 2002). Questions that help children understand Elementary Science. ***Investigating***, Volume 18.2, pp. 6-9

Science can be a method for enabling students to interpret the world around them. Students should ask questions, make predictions, test and retest, make observations, construct events, and then attempt to communicate this information to another person or write it down. This article refers to patterns that are observable. Students will make journal entries about changes, over time, and how those changes have an effect on a living thing in an environment.

Materials

- ❑ Paper towels
- ❑ Wax paper
- ❑ Cookie sheet
- ❑ Paper Clips
- ❑ Illustration Of Berlese Funnel
- ❑ Heat lamp
- ❑ Wide mouth jar
- ❑ Netting or wire screen
- ❑ A large funnel (metal, paper cup, plastic)
- ❑ Slightly damp soil sample with plant litter
- ❑ Heavy/thick rubber band
- ❑ Medium gauge wire
- ❑ Microscope
- ❑ Science journals

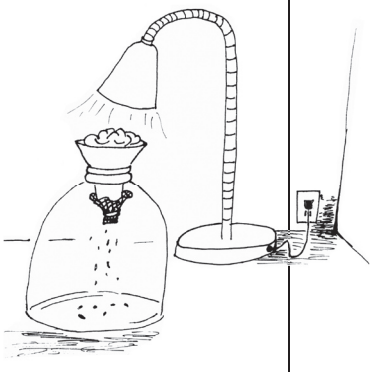
Invitation to Learn

The instructor should invite students to observe. The instructor will wet down individual paper towels to the point of being wet but not dripping. Once done, place one paper towel on a cookie sheet out flat, a second paper towel, roll-up a second lengthwise and paper clip to keep it rolled and place it on cookie sheet. Place the last paper towel between two sheets of wax paper, roll lengthwise and paper clip each end to keep rolled. Ask students to make a journal entry prediction. How will the passing of time affect each towel? Entries could be based in 30 minute, one hour, and 24 hour increments for each towel. When time has lapsed, ask: "What has happened to the moisture in each paper towel over time? Can this same change be applied to a living organism? What might happen if these samples were outside?"

Instructional Procedures

Construct a Berlese funnel to be used in the classroom. The purpose of the funnel is to make available a small environment that can be heated and allow the students to observe what effect the heat has on organisms living in the soil, if any.

1. Place wire screen over the narrow end of the funnel and mold to shape of funnel end. Place elastic band or wire around screen to hold in place.
2. Invert funnel over large empty jar. A clean, white folded paper towel could be placed in jar bottom.
3. Carefully pour soil sample into funnel. Wire mesh should be fine enough to prevent soil from coming through.
4. Position heat lamp over soil sample to heat and dry out sample. Leave light on for several hours or overnight, if possible.
5. The change in moisture content and soil temperature should drive the soil organisms farther down in the soil and force them out into the jar.
6. Discussion– "What change took place on the nonliving soil when the lamp was turned on?" "What happened to the organisms living in the soil when the heat was added?" "How is this like a human being out in a desert?"
7. Journal entry– What part does the soil play in this small environment? What part does the heat lamp play or what is the lamp like in our environment?



Assessment Suggestions

- Journal entries– Response to the paper towel activity, predictions and question answers.
- Draw, in journals, what they see at the bottom of the jar. Write a description of organisms found in bottom of jar.
- Make a chart showing, on a scale from 1-10, one being dry to 10 being damp, how the paper towel feels after 30 minutes, one hour, three hours, 24 hours.

Curriculum Extensions/Adaptations/ Integration

- Distilled water could be added to jar to collect organisms that could be viewed with microscopes.
- Soil samples could be collected by students from different areas such as cool shade, near ditch banks, open fields, sandy soils, etc.
- Paper towel activity could also be done in a shaded area and/or in full sun. Students would predict and log outcome differences specific to this areas.

Family Connections

- Students could make a Berlese funnel at home to share with family using a plastic bottle cut in half, inverted over bottom half of bottle and using a desk lamp.

Additional Resources

Web sites

http://www.ctic.purdue.edu/CTIC/Berlese.html

Shrink to Fit

Science Standard II

Objective 2

Standard II:

Students will understand that organisms depend on living and nonliving things within their environment.

Objective 2:

Describe the interactions between living and nonliving things in a small environment.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills

Content Connections:

Compare things and events.

Connections

Background Information

Prior to this activity, the teacher should instruct and give opportunities for the students to recognize what makes a living organism. An understanding of an environment, on the part of the student, is also expected. Questions such as: What are the characteristics of an organism? 1) Does it breathe? 2) Does it eat? 3) Does it move? 4) Does it reproduce? should have been discussed.

Research Basis

Newton, L.D. (June 2002). Questions that help children understand Elementary Science. *Investigating*, Volume 18.2, pp. 6-9.

Teachers want to help every child understand science however; do teachers ask the right questions that can guide a student to comprehension? Questions about science need to be presented to assist a student to achieve this goal. Asking the right question at the right time can help a student make a mental connection. A carefully tailored question can be an effective tool.

Invitation to Learn

Ask: "What if you could shrink a pond into a bowl, what kinds of items would you need to have in order for those living things in the pond to survive?"

"What if you could shrink a forest into a glass box, what kinds of items would you need to have for the forest creatures to survive?"

Instructional Procedures

1. Using the overhead projector, show students the Forest Scene. Ask students to identify all of the living items in the scene. Ask

them to now identify the non-living items in the scene. This is just the discussion phase.

2. Go back and ask them to again identify the items. Start with the non-living items. Next, ask them to identify the living items. Help students to observe the many living and non-living things that make up the forest environment.
3. Hand out *Shrink to Fit* worksheet and ask them to have pencils ready. Place *Shink to Fit* worksheet on the projector. Add *Overlay A* and ask, "What can you add to your picture that is a non-living thing that can help a creature to survive in the forest?" Add *Overlay B* and *Overlay C* and suggest items such as large rocks, small stones, gravel, dead trees, clouds, standing or running water, etc. As the instructor is drawing or placing overlay, students should be drawing similar items on his/her worksheet.
4. "What living things can you add to this picture that will help creatures to survive?" Again, draw or place *Overlay D* & *Overlay E* to show items such as large and small trees, grasses, bushes, plants, and insects. Collect completed worksheets as an assessment.
5. Discussion– "What happens to the animals when we make a small forest and place it in a small container?" "How is this like a zoo and how might the creatures living there react to living in a smaller environment?"
6. Journal entry– If you woke up one morning to find that you were only six inches tall, how might the world look to you? Describe how your world now would look to you then.
7. Students are now given an eye loupe. Direct students to go outside and explore the out of doors with the eye loupe. Instruct them to make careful observations, as they will be expected to record their observations.
8. Students might be asked to collect items, with teacher's permission, that are living and non-living to be viewed under a microscope. Discuss and/or record observations.

Materials

- ❏ Overhead projector
- ❏ *Shrink to Fit* Overlays
- ❏ *Shrink to Fit* student worksheet
- ❏ Clear plastic terrarium
- ❏ Materials to place inside terrarium
- ❏ Directions to fill terrarium
- ❏ Diorama template
- ❏ Scissors, crayons, glue, pencils
- ❏ Eye loupes

Assessment Suggestions

- Involvement in the discussion can be an observable assessment.
- Complete *Shrink to Fit* worksheets. Students might write reasons why a specific item was or was not included.

- Journal entries and/or written responses about what the student observed when trying to shrink the forest into a small space.
- Completed diorama with correct labeling.

Curriculum Extensions/Adaptations/ Integration

- Instructor should allow students to choose a color used in making the diorama or give students a paint chip to use and allow students to go outside and find items of similar colors that are living and nonliving.
- Ask students to explain, either written or verbally, why nonliving items and living items are needed in any given environment.
- Language Arts: Students can write a "Compare and Contrast" paper about how an environment needs living and non-living items.
- Library/Media: Students will share ideas on visual perspectives as with wide-angle shots, medium angle and close range shots.
- Social studies: How might this forest change if a human comes there to camp or hunt? How might humans help keep a pond or forest environment livable for the creatures living there?
- Use the diorama template. Using pictures from template and student-made items, students will cut, color, and paste items onto the diorama and label each living and non-living item.

Family Connections

- Students are asked to bring in and share terrariums and/or aquariums from home and explain why certain items are needed to replicate an animal's natural habitat.
- Send a parent letter home to find a parent or community person who deals with helping to preserve or clean the environment. Ask them to come into the classroom and share their knowledge.

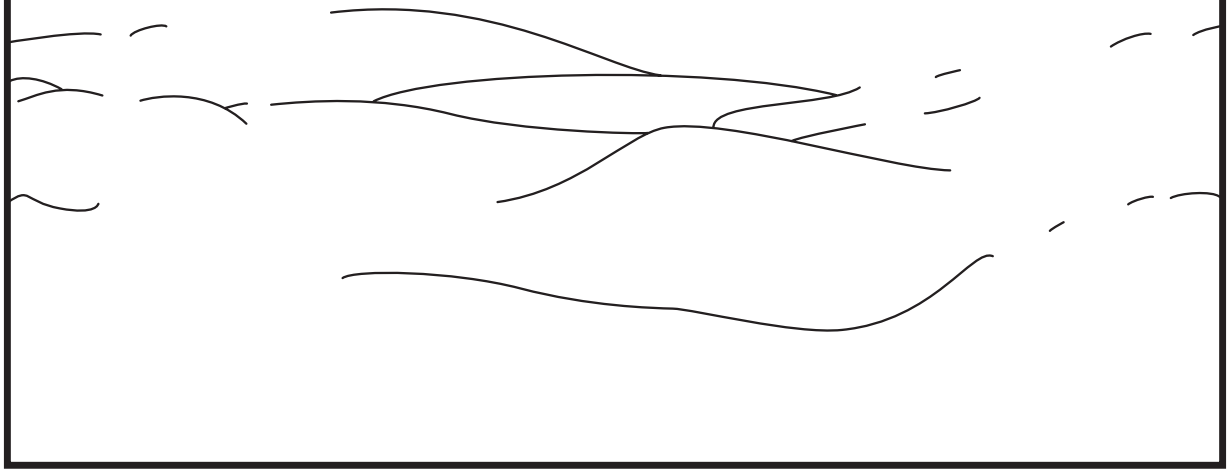
Additional Resources

Books

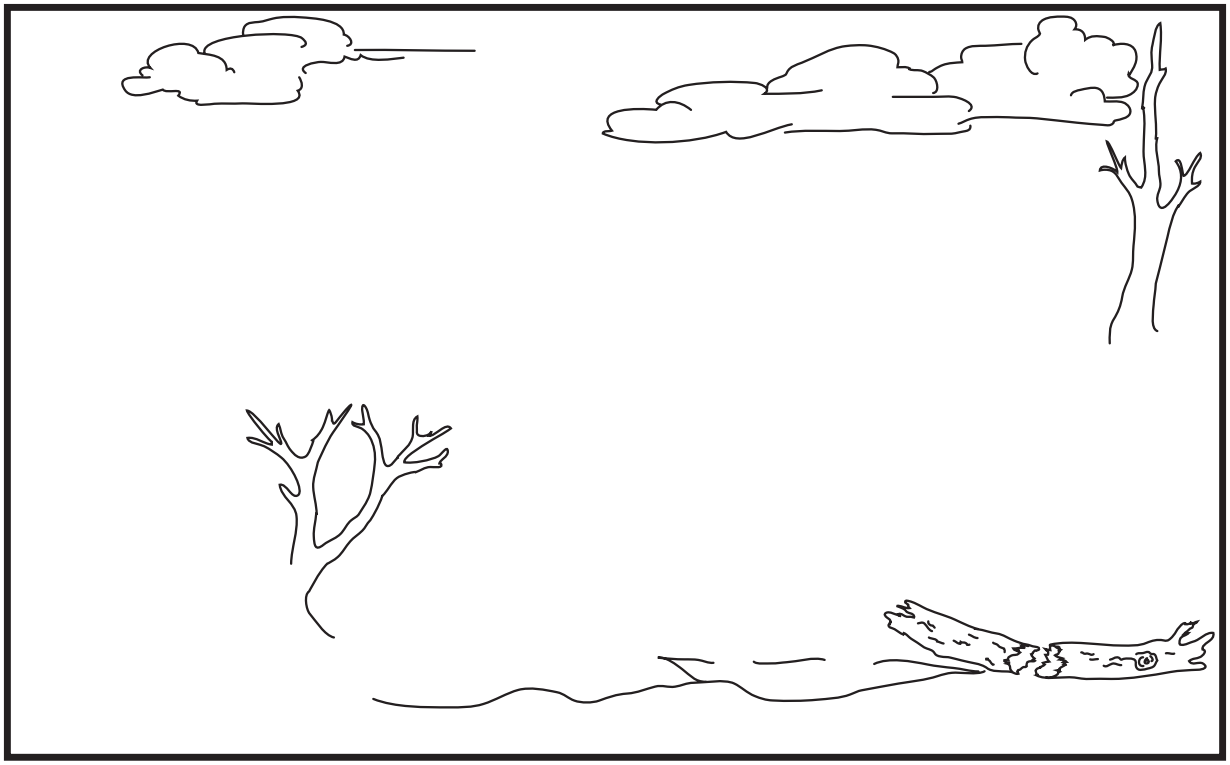
Nature Hide & Seek: Woods & Forests, by John Norris Wood & Maggie Silver; ISBN 1-890409-03-0

Shrink to Fit

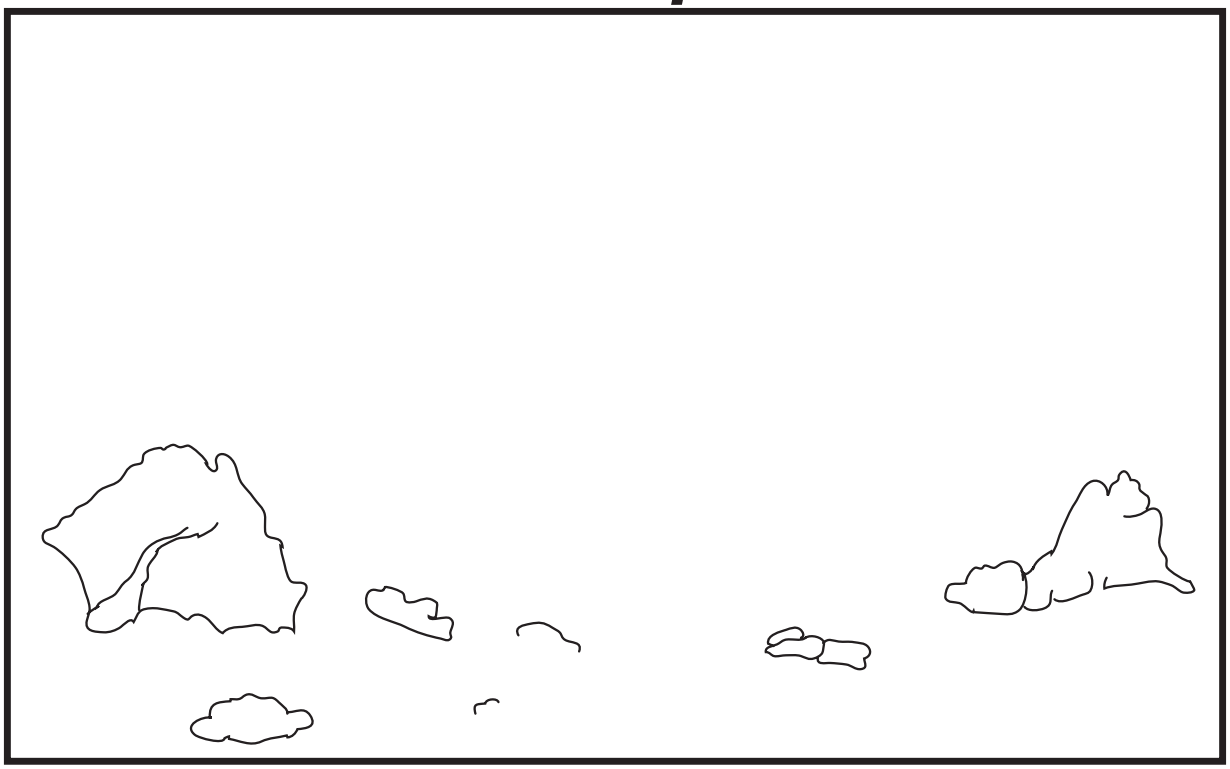
Overlay A



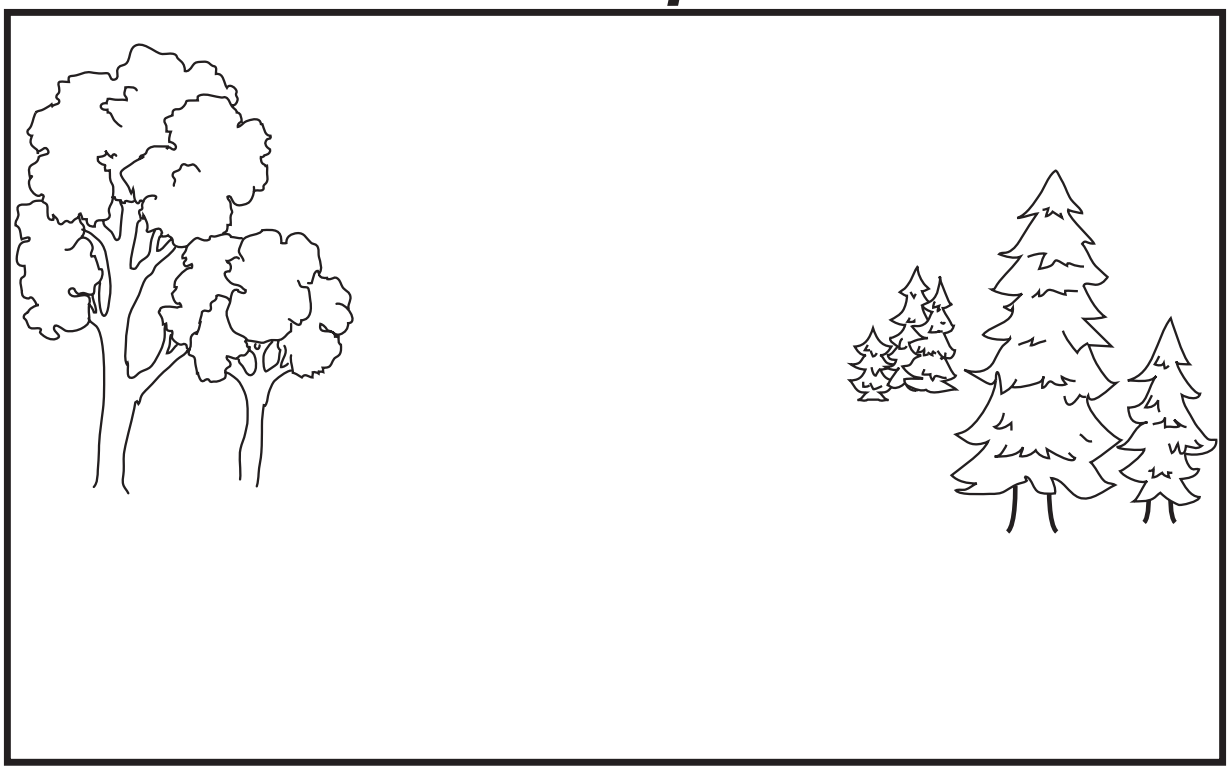
Overlay B



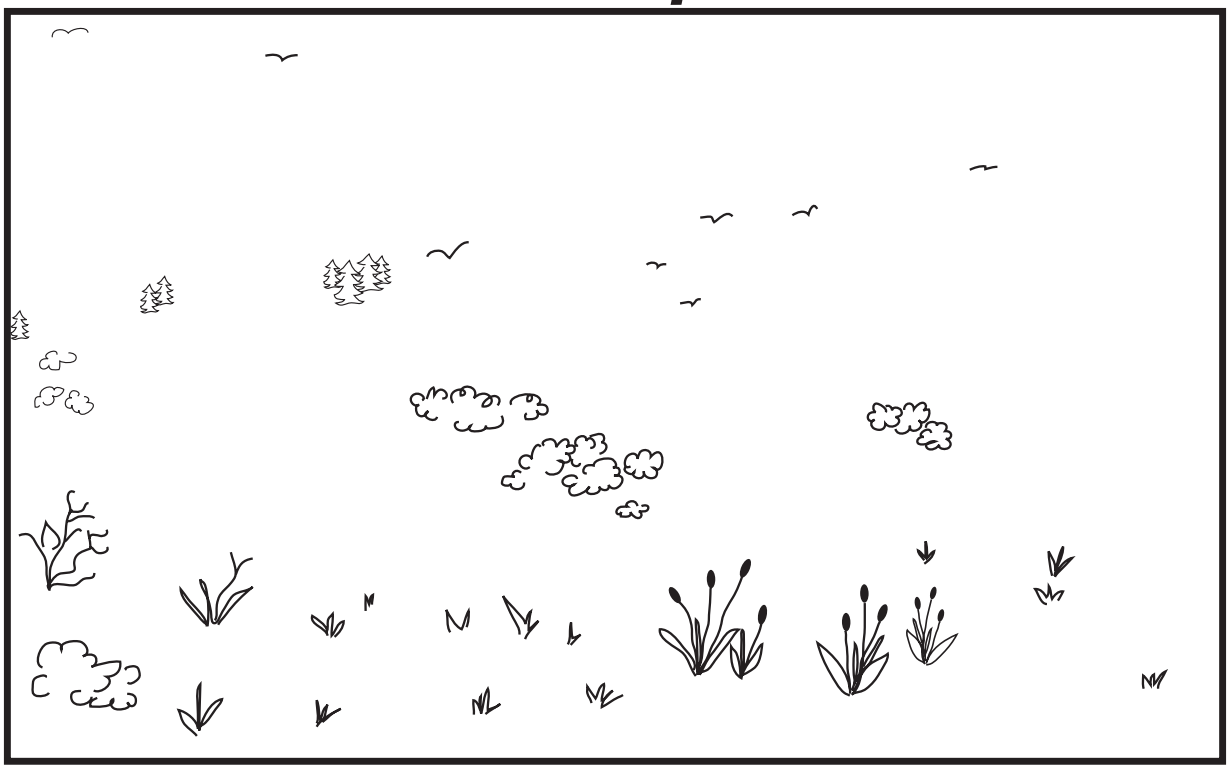
Overlay C



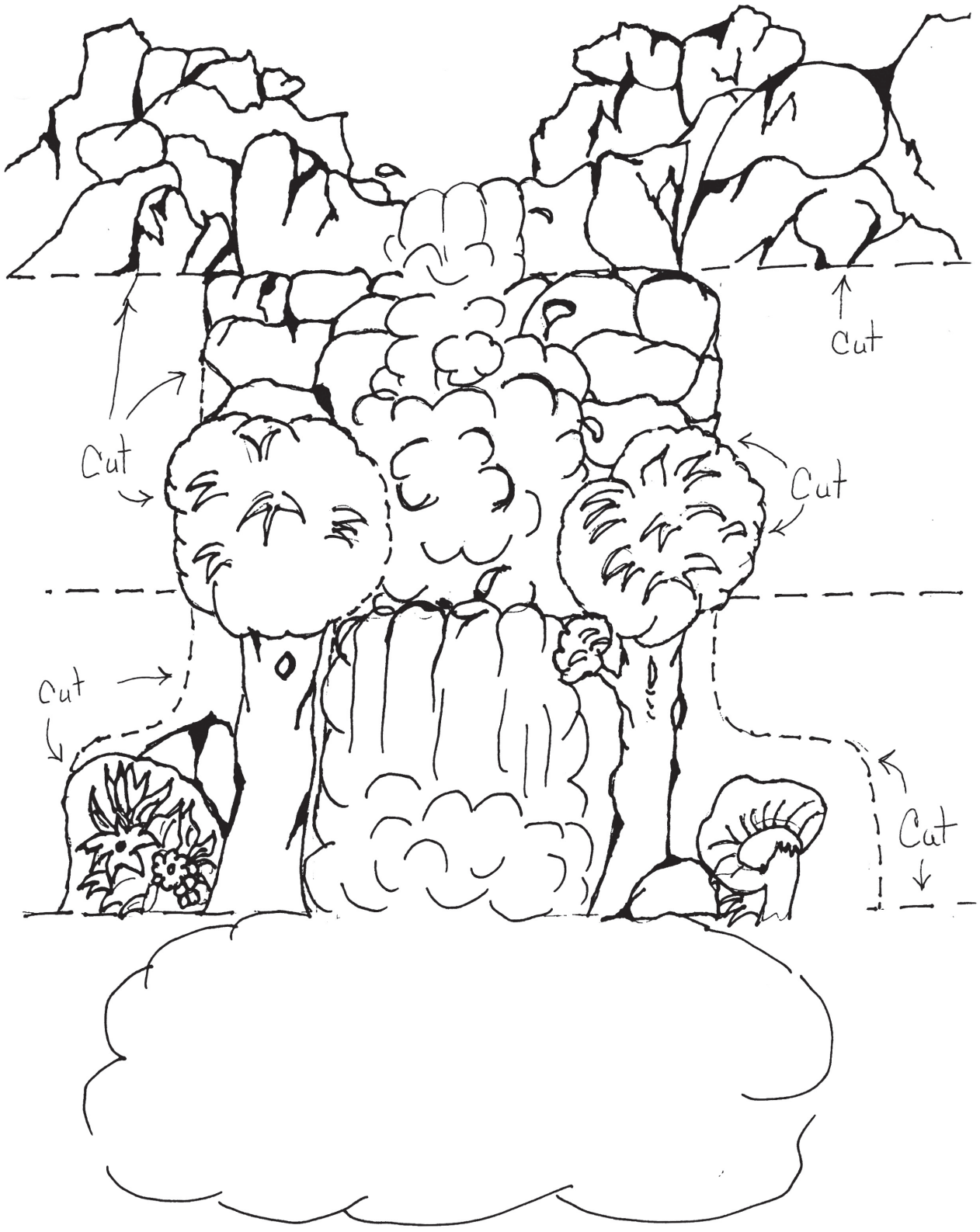
Overlay D



Overlay E



Diorama Template



Diorama Template (Back)

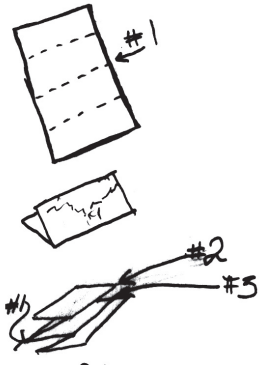
Line 3

Line 1

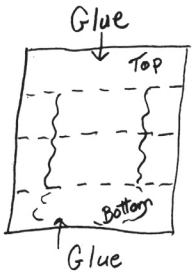
Line 2

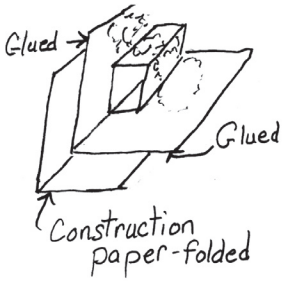
Instructions to Make Diorama

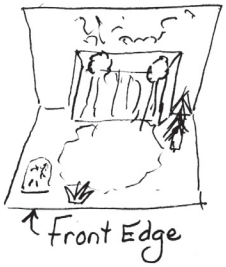
1. Color picture before cutting or adding glue.
2. On back of picture, there are three dotted fold lines. Fold picture in half with picture outside or showing on line 1.
3. Fold on line 2 and line 3 back over picture.
4. Cut along dotted guide lines to outline scene. Cut along top of trees to help give that three-dimensional effect.
5. Fold construction paper in half.
6. Apply glue to top section of page with picture to construction paper. Line up edges of picture page with edge of construction paper. Match corners, see below.



7. Apply glue to bottom section of page with picture to bottom edge of construction paper. Line up edges of page and match corners.
8. To add other features: Cut out animal pictures. Be sure to leave tab at bottom of each picture to use as a glued base. Draw your own animals and other forest features.
9. Line paper can be applied to back labeling details.

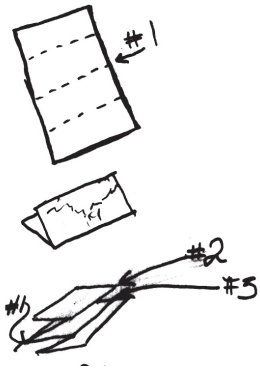




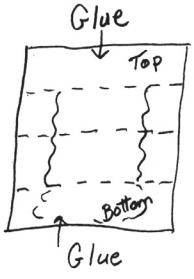


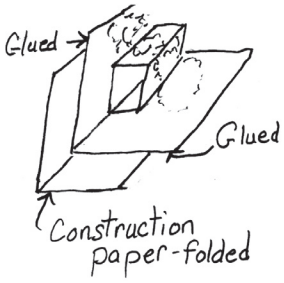
Instructions to Make Diorama

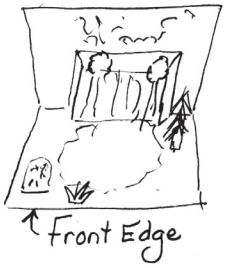
1. Color picture before cutting or adding glue.
2. On back of picture, there are three dotted fold lines. Fold picture in half with picture outside or showing on line 1.
3. Fold on line 2 and line 3 back over picture.
4. Cut along dotted guide lines to outline scene. Cut along top of trees to help give that three-dimensional effect.
5. Fold construction paper in half.
6. Apply glue to top section of page with picture to construction paper. Line up edges of picture page with edge of construction paper. Match corners, see below.



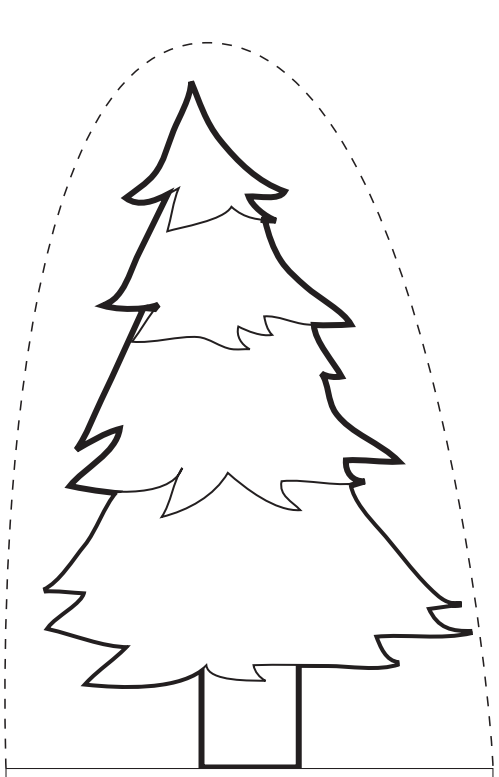
7. Apply glue to bottom section of page with picture to bottom edge of construction paper. Line up edges of page and match corners.
8. To add other features: Cut out animal pictures. Be sure to leave tab at bottom of each picture to use as a glued base. Draw your own animals and other forest features.
9. Line paper can be applied to back labeling details.



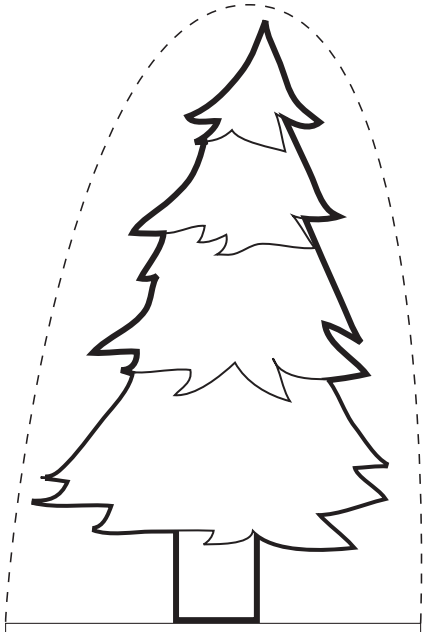




Diorama Features



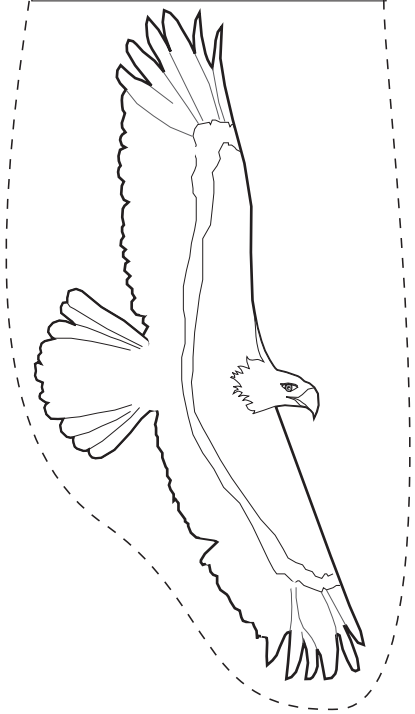
Evergreen

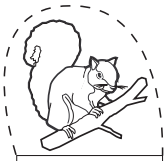


Evergreen

foliage

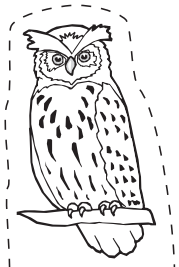
Eagle



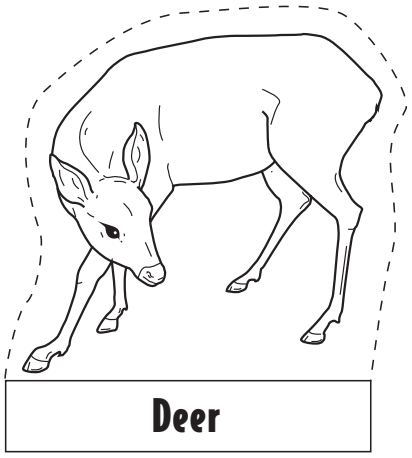


Squirrel

Rabbit



Owl



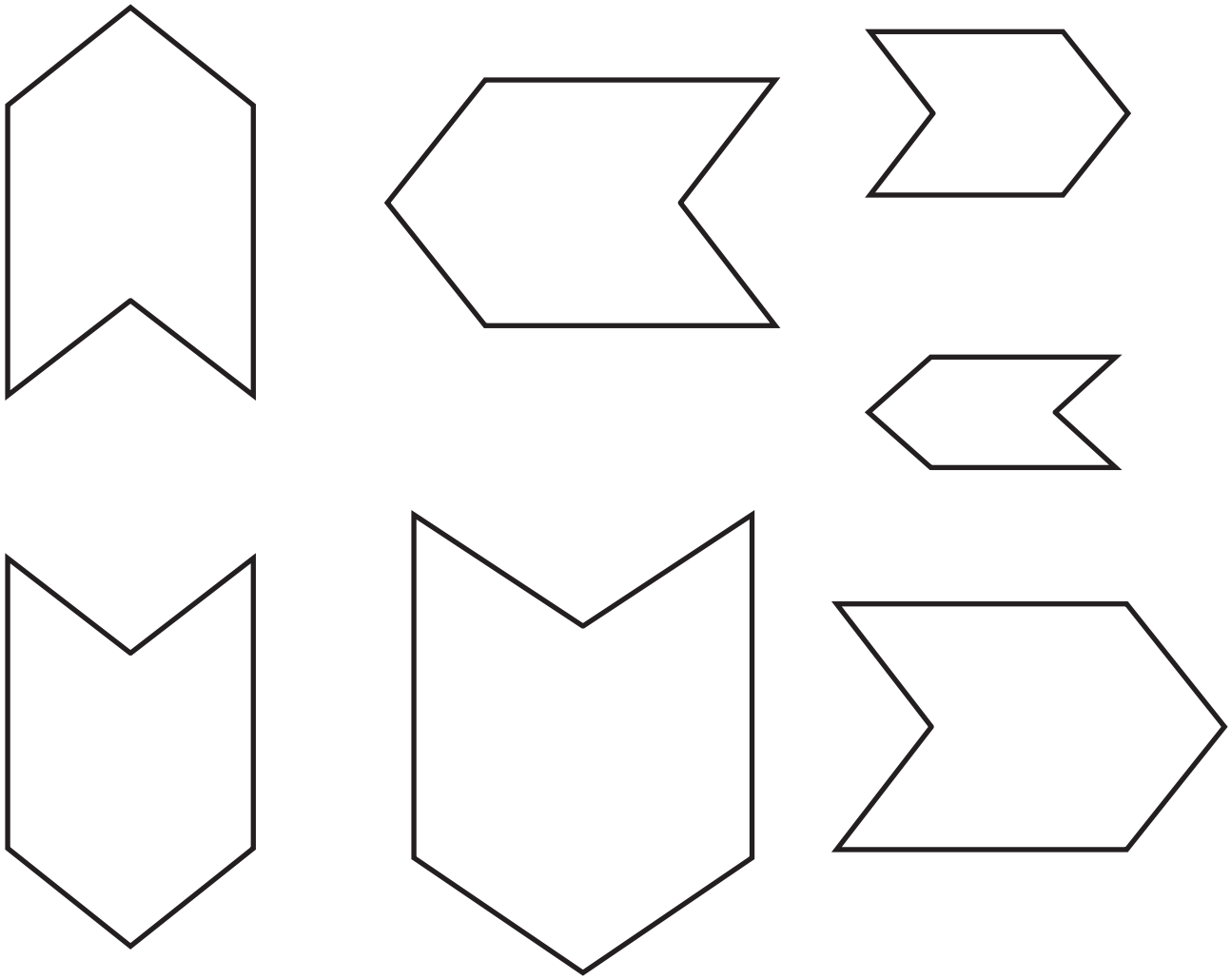
Deer

Appendix

Name _____

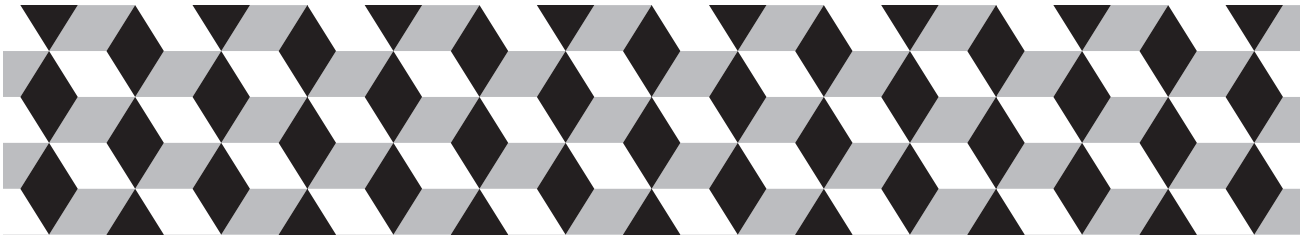
Assessment for Slides, Flips, & Turns

1. Color and cut the shapes that are congruent.
2. Paste one of the shapes on a piece of grid paper and label it #1.
3. Use a second congruent shape to show a slide of the first shape on the grid paper. Paste the second shape on the paper and label it "slide."
4. Use a third shape to show a flip of the first shape on the grid paper. Paste the third shape on the paper and label it "flip."
5. Use a fourth shape to show a turn of the first shape on the grid paper. Paste the fourth shape on the grid paper and label it "turn."



Name _____

An Important Thing



The important thing about a cube is _____

_____

It has _____

_____

_____

It is like _____

_____

It doesn't have _____

_____

It can be found _____

_____

But the important thing about a cube is _____

_____

_____

Name _____

The Night Sky Recording Sheet

Question: Why does it seem that objects like the sun, moon, and stars move across the sky?
Gather Information:

_____

_____

Hypothesis: I think that

_____

_____

Experiment: Draw what you see at each time in the appropriate box as you "rotate".

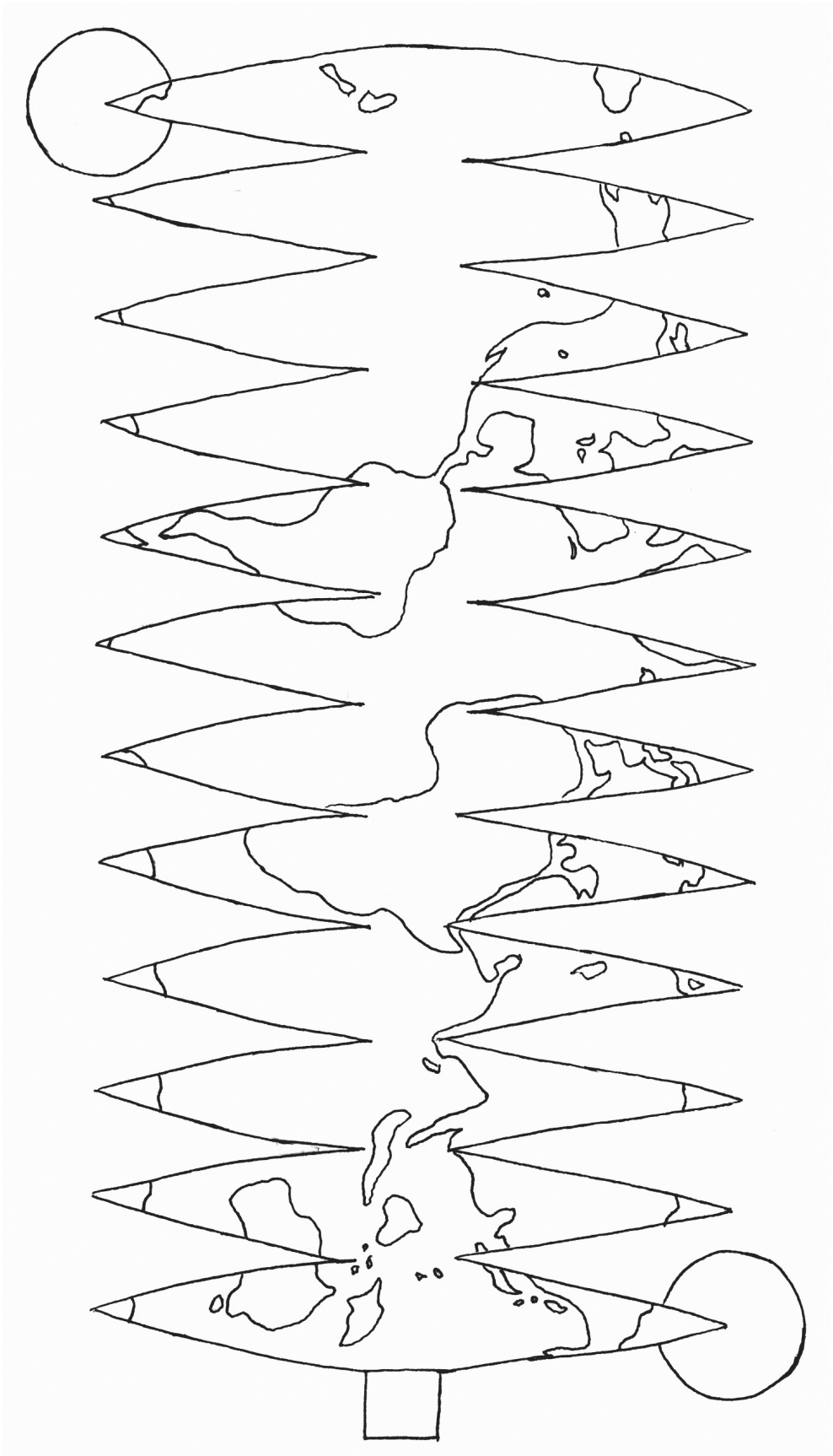
Earth

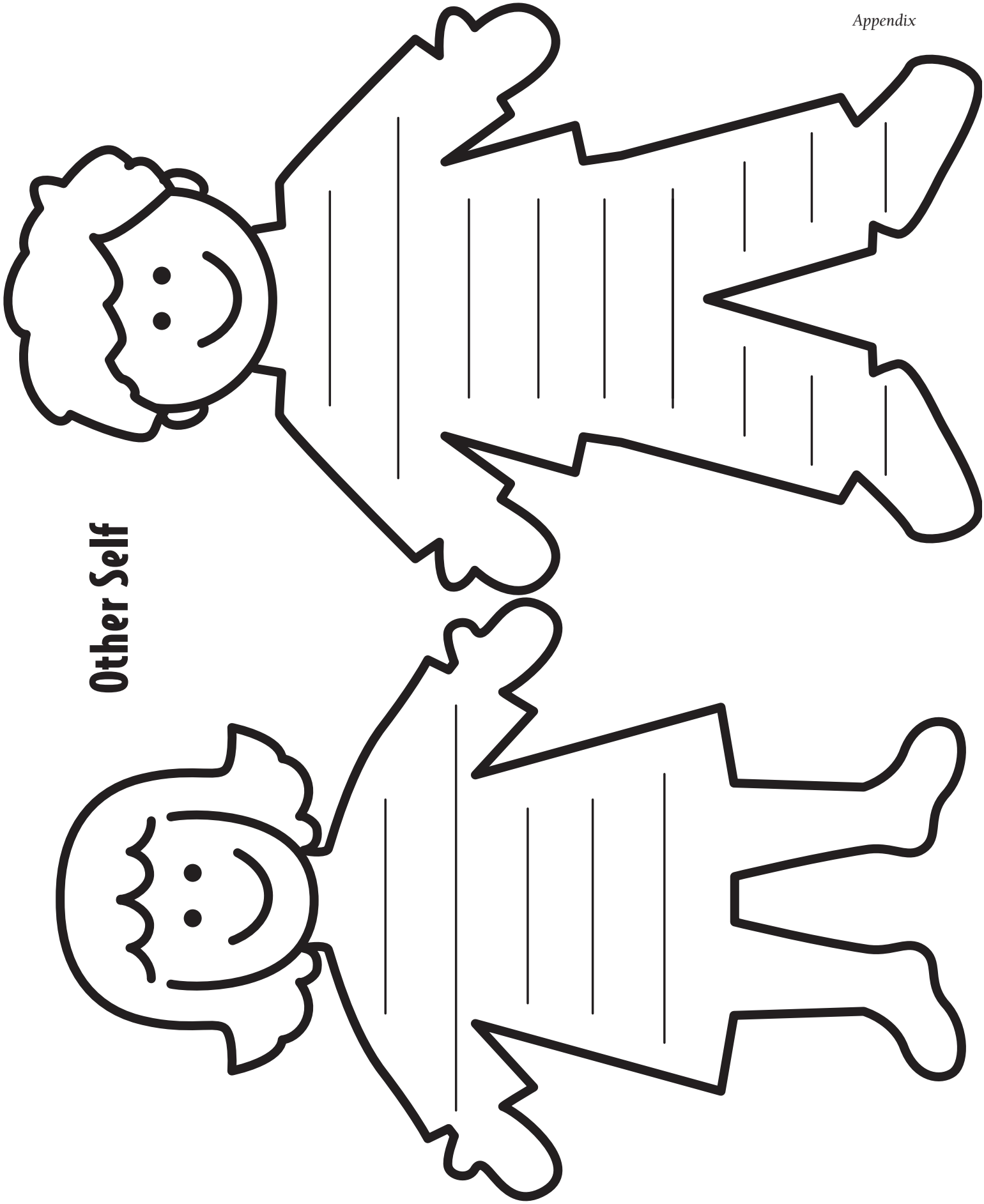
11:00 p.m.
1:00 a.m.
3:00 a.m.

5:00 a.m.
10:00 a.m.
3:00 p.m.

Conclusion: The sun, moon, and stars appear to move across the sky because:

Tennis Ball Globe




Other Self

Container Capacity

Names of members of the group: _____

Container #1 Description of container: Estimate _____How many cups? Actual capacity _____	**Container #2** Description of container: Estimate _____How many cups? Actual capacity _____
Container #3 Description of container: Estimate _____How many cups? Actual capacity _____	**Container #4** Description of container: Estimate _____How many cups? Actual capacity _____