

ELEMENTARY CORE ACADEMY

TEACHERS OF UTAH, LOCAL SCHOOL DISTRICTS,
UTAH STATE OFFICE OF EDUCATION, & UTAH STATE UNIVERSITY

a professional
development
resource

UtahState
UNIVERSITY

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- 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

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Dear Core Academy Teachers:

Your involvement in the Core Academy represents a significant investment by you, your school, and district in educational excellence for the students of Utah.

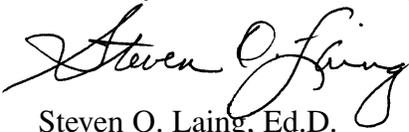
I commend you for your dedication and willingness to engage in meaningful professional growth. Efforts by teachers and administrators to develop, provide, and participate in high quality professional development programs must continue if we desire quality learning experiences for all children.

As the needs of students change, it is critical that educators adjust to meet those needs. Teachers should continue to gain expertise in the collection and use of accurate data and analysis of each student's level of achievement. This investment in accountability will empower teachers, parents, and others educators to be more effective.

Exemplary models of instruction, practical application, and collegial support must be an integral part of all professional development. Embedding sound instructional methods that specifically align to the state Core Curriculum will equip teachers with the skills and tools to meet the needs of Utah students.

It is my belief that educators care deeply about their students and work hard to create successful experiences in the classroom. Despite some challenges facing our schools, dedicated and professional educators make profound differences each day.

Sincerely,



Steven O. Laing, Ed.D.
State Superintendent of Public Instruction

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Major funding for the Academy comes from the following sources:

State Funds:

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

- Federal Funds: ESEA Title II

- WestED Eisenhower Regional Consortium

District Funds:

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

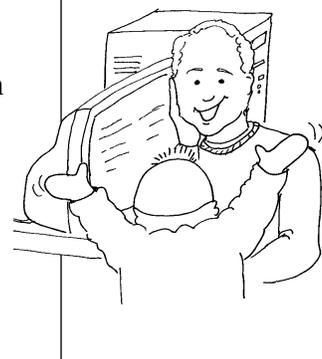
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- Trust land, ESEA Title II, and other school funds
- Utah State Office of Education Special Education Services

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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 newly adopted 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.

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***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.

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

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



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

The Core is:

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

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 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.

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

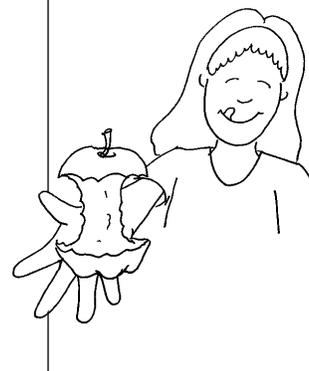
1. Demonstrate a positive learning attitude toward mathematics.

- 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.

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



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 Standards

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.

- Model, read, and write *whole numbers* up to 10,000 using base ten models, pictures, and symbols.
- Write a *numeral* when given the number of thousands, hundreds, tens, and ones.
- Write a number up to 9,999 in expanded form (e.g., 6,539 is 6 thousands, 5 hundreds, 3 tens, 9 ones or $6000+500+30+9$).
- Identify the place and the value of a given digit in a four-digit numeral.
- 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.

- Use a variety of strategies to determine whether a number is even or odd.
- Identify the number that is ten more, ten less, 100 more, or 100 less than any *whole number* up to 1,000.
- Compare the relative size of numbers (e.g., 31 is large compared to 4, about half as big as 60, close to 27).
- Compare whole numbers up to four digits using the symbols $<$, $>$, and $=$.
- 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.

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

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



- 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., $3 \times 4 = 12$; thus, $12 \div 4 = 3$ and $12 \div 3 = 4$).
- 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 \sim , \triangle , or \diamond in an addition, subtraction, or multiplication equation, represent a value that will make the statement true (e.g., $5+7=\triangle$, $\sim-3=6$, $\diamond=2\times 4$).
- b. Solve equations involving equivalent expressions (e.g., $6+4 = \sim+7$).
- c. Use the $>$, $<$, and $=$ symbols to compare two *expressions* involving addition and subtraction (e.g., $4+6 \sim 3+2$; $3+5 \diamond 16-9$).
- 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., $3\times 7=21$, $7\times 3=21$).
- 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., $7\times 1=7$), and the *zero property of multiplication* (e.g., $6\times 0=0$).

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

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 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.

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.

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.

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



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**

- 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.

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.

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>

- **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.**



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.

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.

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



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.

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

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

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.

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.

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

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

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.

- 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.

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

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.

Starter Activities

Starter Activities

Starter Activity 1–Math

Number sense: How many ways can you show or represent the number three on one hand? Answer: ten

Possible materials needed: a pencil and paper with 20 hand prints so you can cross off the fingers

Starter Activity 2–Math

Number sense: Have the participants finish a simple addition chart from 1 - 9 or have it all ready prepared. Have the participants examine their chart and color patterns and describe to the other participants how to use the chart to add or subtract simple numbers.

Materials needed: Colored pencils and addition chart

Starter Activity 3–Science

Water Cycle: Create and play the game from Project Wet.

Materials: dice and posters and a set of the rules for each teacher

Starter Activity 4–Science

Water Cycle: Discuss with a partner your understanding of the following: (write the questions on the board)

1. What is needed for weather?
2. How do rain and snow form?
3. What are the steps in the water cycle?

Materials: note-taking materials

** Remind them to risk answering even if they are not sure of the correct answer**

Starter Activity 5–Math

Patterns and Relations: Have the participants again use a simple addition chart from 1 - 9. Have the participants examine their chart and use a colored pencil to put red squares around all the numbers that are multiples of three. Then have them use a blue pencil to circle all the numbers that are multiples of four. As students look for “Common Multiples,” point out that they are the numbers with both red square and blue circles around the number.

Materials needed: Colored pencils and addition chart

Starter Activity 6–Math

Patterns and Relations: Have the participants finish a simple multiplication chart from 1 - 9 or have it already prepared. Have the participants examine their chart and color patterns and describe to the other participants how to use the chart to multiply or divide simple numbers.

Materials needed: Colored pencils and multiplication chart

Starter Activity 7–Math

Patterns and Relations: Explain to the participants that a palindrome is a number or word that is the same front to back and back to front (e.g. dad, 7,665,667, mom, stats). Have them find the next date on which there will be a palindrome using mm/dd/yy. Are there any other creative dates using patterns (e.g., 03/03/03 at 03:03 in the day)? What pattern day is next?

Materials: pencil and paper

Starter Activity 8–Science

Weather: Create a cloud in a 2-liter bottle. Put hot water and smoke in a clear 2-liter bottle. Cap the bottle, squeeze hard, and you will see a small cloud form as you are squeezing. “Why do you need smoke in the bottle? And if pollution is needed in the bottle, what role does pollution play in weather and the formation of clouds, rain, and snow?”

Materials: Clear 2-liter bottle with a cap, hot water, matches for smoke

Starter Activity 9–Science

Weather: For another model of a cloud, fill a plastic clear cup $\frac{2}{3}$ full with warm water. Put a lid (preferably clear) on the container. Put two ice cubes on the top of the lid. After a few minutes, water droplets should appear at the top of the container on the inside.

Materials: one clear cup with a clear lid per participant, warm water

Starter Activity 10–Math

Geometry: Have the participants start a geometry journal and have them make lists of vocabulary words and pictures to go with their words to help explain and understand geometry. Vocabulary words may include point, line, line segment, angle, plane, intersecting lines, perpendicular lines, parallel lines, ray, triangle, square, rectangle, polygon, circle, same, similar, etc.

Materials needed: pencils and paper (geometry journal)

Starter Activity 11–Science

Rocks and Minerals: Have a selection of rocks and minerals available for students to observe and classify. Have hand held microscopes and hand lenses available for observation. Have the teachers classify their samples based upon observations.

Materials: Samples of 10 rocks or minerals that the teachers can observe, hand lenses, a couple of hand held microscopes (Radio shack)

Starter Activity 12–Science

Rocks and Minerals: Get 4-5 soil sand samples from the same vicinity. Try to get different colors. Then find a sand pile with similar sized particles. See if the teachers through observation, can pick the soil samples that belong to each other in comparison to the implanted sample. This is a great activity for using inquiry skills.

Materials needed: 4-5 sand samples, hand held microscopes or hand lenses

Starter Activity 13–Science

How hot is hot? How cold is cold? How long is long? Short? Tiny? Big? Small? There are a lot of words we use to describe terms and objects in science. This is a great way to help participants understand that comparisons need to be made in quantifiable measurements rather than general statements. Give the participant an object in a bag and have them describe it (e.g., ice cube).

Starter Activities Notes

Starter Activities Notes

Inquiry

Activity–Tetrominoes Cover-Up

Standard III

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

Objective 3

- 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.

Standard III

Objective 3

Connections

Math Inquiry Lesson

Adapted from an activity described in: National Council of Teachers of Mathematics, (2001). *Navigating through Geometry in Grades 3-5*. Reston, VA: Key Curriculum Press.

Background Information

Important Geometric Terms:

Translation (slide): A transformation that slides a figure to a new location without changing its orientation. A translation is also called a slide.

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

Rotation (turn): A transformation that occurs when a figure is turned a certain direction around a point. A rotation is also called a turn.

Congruent: A figure having exactly the same size and shape.

Instructional Procedures

Engagement

1. Hand out square tiles to pairs of students. Demonstrate on the overhead projector the rules for arranging the tiles:
 - Each square must share a common side.
 - Tiles must be laid flat; no stacking is allowed.
2. Have the students use 4 squares to try to find as many two-dimensional tetrominoes as possible.
3. Students trace the shapes onto 1" grid paper and cut them out, checking for duplicate congruent shapes caused by rotations and

Materials

For each pair of students:

- Two copies of Tetrominoes Cover-Up Game Board
- A “Tetrominoes Die”
- One inch square tiles
- Crayons, markers, scissors, glue

For the classroom:

- Overhead projector
- Overhead transparency of “Tetrominoes Cover-Up Game Board”

flips. Demonstrate congruence by saying, “I can prove these are congruent by rotating,” or “I can prove these are congruent by flipping.”

4. Discuss the class discoveries, using the following questions to guide students’ thinking;
 - Do you have all possible tetromino shapes?
 - How do you know?
 - Are some of the tetrominoes the same?
 - How can you prove it? (By turning, flipping, or sliding the tetrominoes and placing them on top of each other, we can prove they are the same or different. They are the same when they fit exactly on top of each other, proving that they are the same size and shape.)

Exploration

1. Students play “tetrominoes cover-up” with the tetrominoes they have just made. The object of the game is to completely cover up the 8 x 6 grid on the game board with their tetromino shapes. They are to try to have the least amount of uncovered squares with no overlapping.
2. Hand out a die pattern and game board to each student and have them make their own die. When the die is rolled, the figure that appears on top is the tetromino to be used for that turn. A player whose roll shows a “Free Choice” may play a piece of his or her choice.
3. Model on the overhead projector how to play the game. Each pair will decide who will go first. Player 1 rolls the die to determine a tetromino piece to play. They place the tetromino on their game board so that one side touches either the bottom of the game board or (after the first round) another tetromino. They may use slides, flips, or turns to place the selected tetromino so that the fewest squares will be left uncovered on the game board. The player then colors the squares that are covered by the selected tetromino.
4. Player 2 rolls the die to determine the tetromino to be placed on their game board. Play continues until no more tetrominoes can be placed on either game board. The players determine their scores by counting the total number of squares not covered on their own game board. The winner is the player with the lowest score.

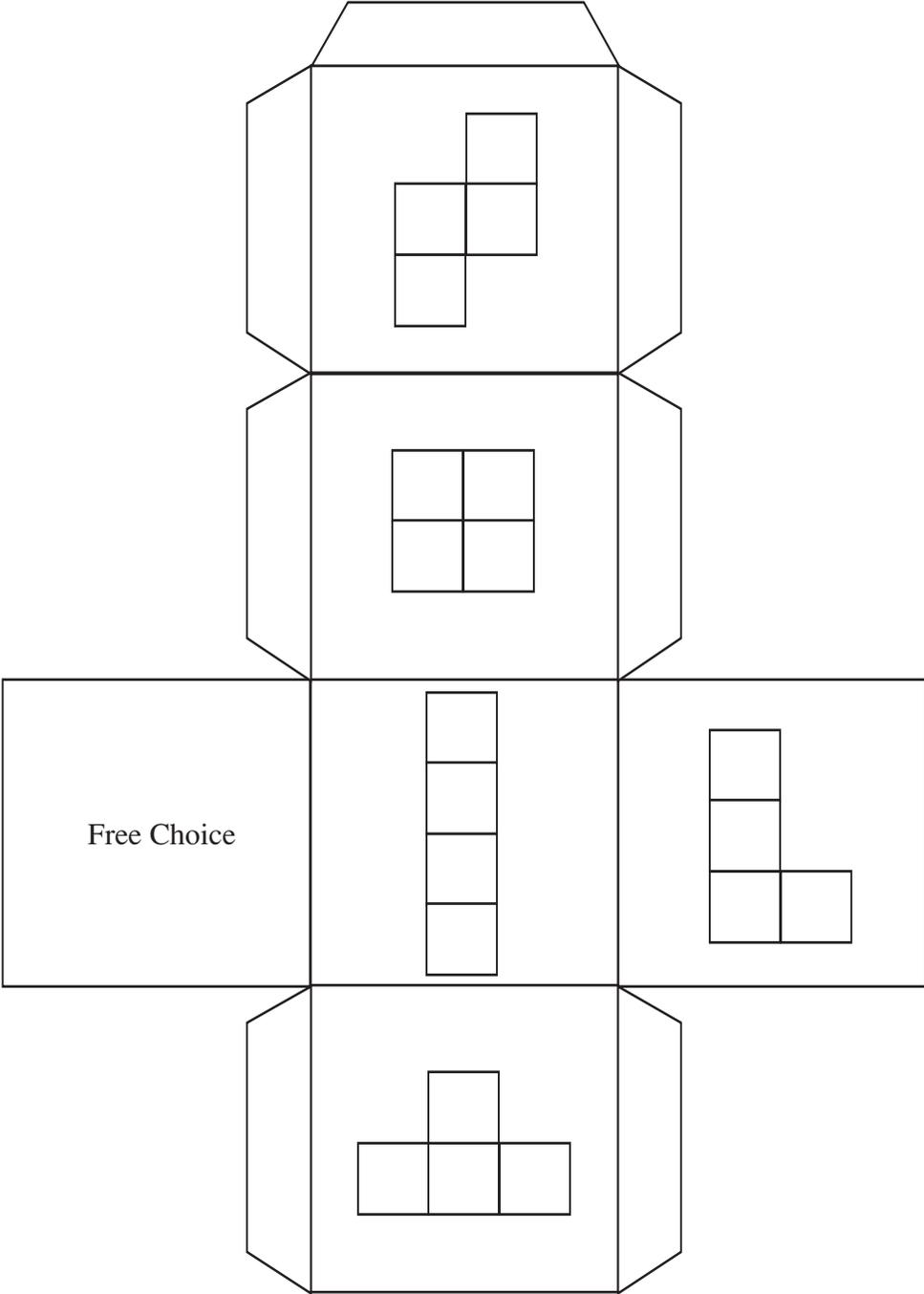
Explanation

1. When all the students have played the game at least once, discuss with the whole class some strategies they have discovered. The following questions can be used to guide the discussion:
 - Do certain shapes fit together well?
 - How did you decide where to place the tetrominoes?
 - Was one tetromino shape more difficult to place than the others? Why?
 - What was the easiest tetromino shape to work with? Why?
2. Review the terms; translation (slide), reflection (flip), and rotation (turn).

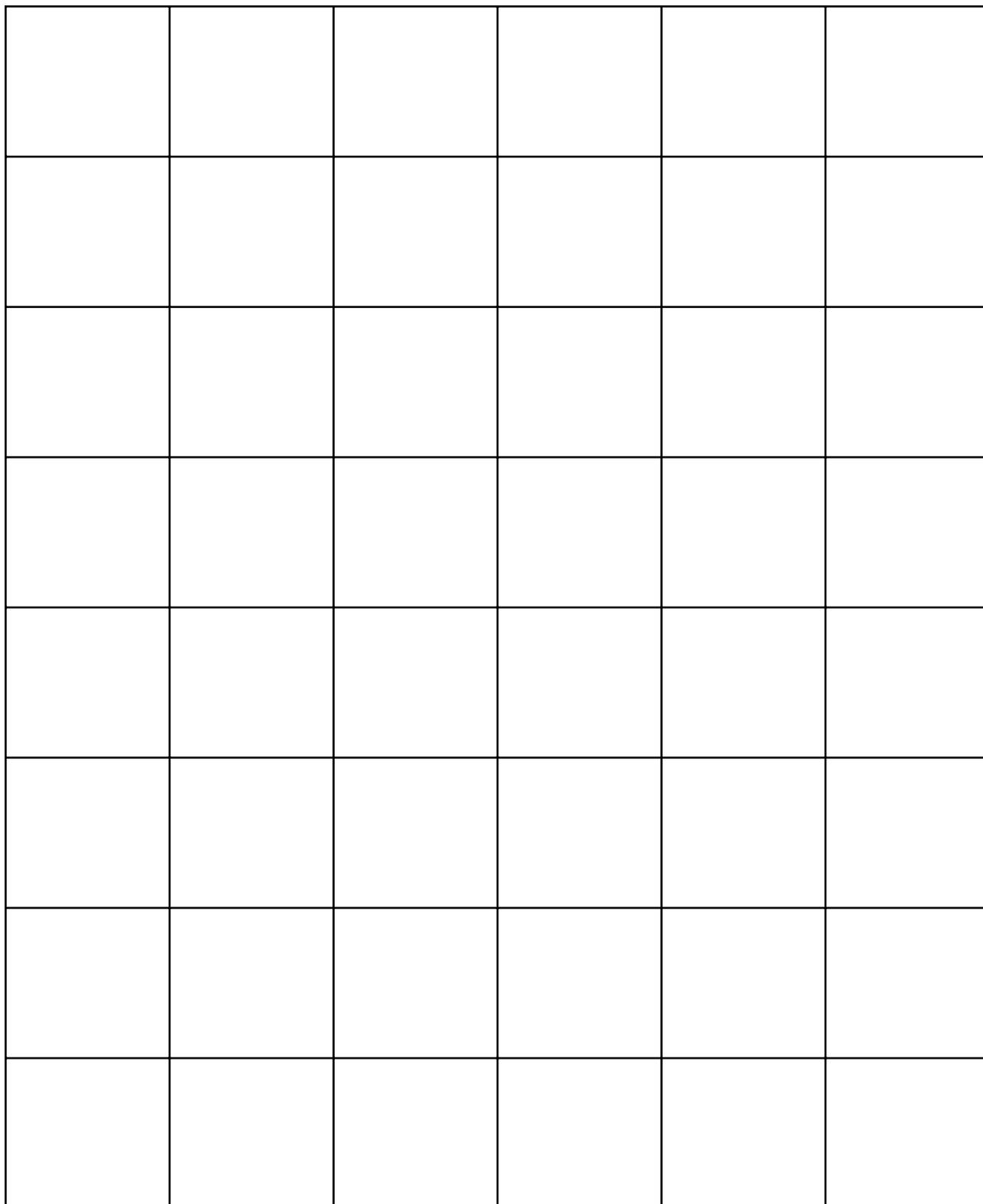
Extension

1. A variation to the above game would be to use six sets of tetrominoes and only one game board. Instead of coloring squares on the game board, the students can take turns rolling to select a tetromino shape and then place the actual tetromino on the game board. When all the pieces of a certain shape have been used, the students either spin again or lose a turn. Play ends when no tetrominoes are left to play or none of the remaining shapes will fit on the playing region. The student that places the greater number of tetrominoes on the game board is the winner.
2. Explore playing the game with game boards of different sizes. Have the students determine which game board was more challenging and tell why.
3. Use several tetromino pieces of the same shape and see which tetrominoes tessellate or cover a surface without any gaps.
4. Students fold the tetrominoes they made to determine which tetromino pieces have symmetry. There may be more than one line of symmetry for some tetrominoes.
5. Students can determine area and perimeter of each tetromino shape.

Tetrominoes Die



Tetrominoes Cover-Up Game Board



Using Inquiry With Students

3rd Grade–Science

Inquiry is knowledge gained through investigation. Inquiries may be teacher-initiated or student-initiated. The Learning Cycle is one of the most familiar and effective models for science instruction using an inquiry approach. The following is the 5-E model of the Learning Cycle:

- Inquiry is knowledge gained through investigation.
- Inquiries may be teacher-initiated or student-initiated.

1. **Engagement Phase:** The teacher sets the stage for learning by getting the students’ attention and focus. The teacher creates ways to “hook” the students into learning. It also provides an opportunity for the teacher to activate learning, assess prior knowledge, and have students share prior experiences about the topic.
2. **Exploration Phase:** Students are engaged in inquiry in response to teacher-posed or student-posed questions. They are encouraged to develop and test a hypothesis without direct instruction from the teacher. They collect evidence and data, record and organize information, share observations, and work in cooperative groups. This stage also provides opportunities for students with diverse experiences to share their different understandings and broaden the perspectives of the entire class. At the end of this phase, students discuss what was discovered and learned from the investigation.
3. **Explanation Phase:** During this teacher-directed stage, the teacher facilitates data-processing techniques from the information collected during the exploration. As the information is discussed, the teacher often explains the scientific concepts associated with the investigation, introducing vocabulary—providing a common language for the class to use. This helps students to articulate their thinking and describe their experiences in scientific terms. The teacher can then continue to introduce details using direct instruction or lecture, audiovisual resources, on-line sources, or computer software programs. This phase is sometimes called the *concept development stage* because newly developed concepts are assimilated into the cognitive structure of the students.
4. **Elaboration or Extension Phase:** During this stage, the teacher provides activities that reinforce the concept. This can be accomplished by applying the evidence to new or real-world situations or through further investigation and/or research.

5. Evaluation Phase: The teacher brings closure to the lesson by helping students summarize what was learned and making connections among the concepts learned and the students' prior knowledge. The teacher then provides a means to assess students' learning. Assessment strategies may include a number of different options, including more traditional summative evaluations (i.e., paper and pencil tests, written descriptions of what has been learned, presentations, as well as performance assessment).

One way to better understand the difference between a guided inquiry lesson and a more traditional, expository lesson (like direct instruction) is to consider the Expository-Discovery Continuum. Teaching methods or lesson plans can be arranged on the basis of the relative amounts of teacher and learner contribution to the learning situation. The following continuum represents a succession of teaching methodologies between a hypothetical totally teacher-dominated expository method on the left and a hypothetical totally student-dominated free discovery method on the right. Any lesson can be located somewhere on this continuum. Guided inquiry, where teachers facilitate children in their investigations of teacher-established topics or questions, fits somewhere in the middle.



Activity—Ramps and Rollers

Standard
IV

Objective
2

Connections

Standard IV

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

Objective 2

Describe the effects of gravity on the motion of an object.

- 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.

Guided Inquiry Lesson (Teacher-Initiated Inquiry)

Adapted from an activity described in: Llewellyn, D. (2002). *Inquire within: Implementing inquiry-based science standards*. Thousand Oaks, CA: Corwin Press.

Intended Learning Outcomes

By nature, Inquiry engages students in many of the ILOs described in the State Science Core Curriculum. Those most evident in this particular lesson include the following:

1. Use Science Process and Thinking Skills
Observe simple objects and patterns and report observations.
Make simple predictions.
Compare things and events.
Use instruments to measure length (and time) using appropriate units.
Conduct a simple investigation.
Use observations to construct a reasonable explanation.
2. Understand Science Concepts and Principles
Explain science concepts and principles using their own words and explanations
3. Communicate Effectively Using Science Language and Reasoning
Use scientific language appropriate to grade level in oral and written communication.

Instructional Procedures

Engagement

1. Using the ruler, marble, and stack of books construct an inclined plane. Demonstrate by rolling the marble down the groove of the ruler and explain that an inclined plane is a slanting surface.
2. Ask each student to list 5 things they know or have observed about inclined planes in their science journal.
3. Have students pair and share their ideas.
4. Invite students to share what they know about inclined planes with the entire class. As they share, list their ideas on the board. Point out that we already know a lot about inclined planes.

Exploration

1. Tell the students that today they are going to be investigating a question about inclined planes. Then pose the question: “How does the height of the inclined plane affect the distance a marble or other round object will roll?”
2. Explain that their task is to plan an investigation or experiment using the materials provided to answer the question. Divide students into teams of 3-4. Ask each team to write a hypothesis and a plan to test their prediction (See Inquiry Data Sheet).
3. After their plan is completed, teams will be free to use whatever materials they need to carry out their plan and collect evidence to test their hypotheses.

Explanation

1. At the completion of the investigations, students should organize their data. Provide them with chart paper and markers to record their hypothesis, procedure, observations, and conclusions. Post all charts.
2. Invite teams to share the results of their investigations, including their hypothesis and what they found.
3. Discuss the results and reach consensus as a class about the answer to the original question. Write this negotiated conclusion on the board. Introduce or reinforce the concept that as the incline becomes steeper, the speed increases. Discuss gravity and why this is so.

Materials

For each group of 3-4 students:

- 1 12-inch ruler with groove
- 1 marble
- Stack of books
- Different sizes of cardboard tubes, cut lengthwise (toilet paper rolls, paper towel rolls, gift wrap rolls, etc.)
- Masking tape
- Various sizes of small balls of different masses and colors (i.e., marbles, “super balls,” ping-pong balls, golf balls, etc.)
- Measuring tape
- Inquiry Data Sheet
- Large piece of chart paper
- Markers
- Tape, tacks, pushpins, tacky or other means of posting charts around the room
- Science Journal (for each student)

Elaboration or Extension

1. Ask students to brainstorm (within their teams) other questions about inclined planes (ramps) and spherical objects (balls) that might be answered using the materials provided (or others that might be available). Invite them to record the questions in their science journal.
2. Share questions within each team.
3. Ask each team to choose one of these questions and plan an investigation or experiment (as above) using the materials provided (and any others they might need) to answer their new question. (Provide a second Inquiry Data Sheet)
4. After the new plan is completed, teams will carry out their plan and collect evidence to test their hypotheses.
5. Students will then be asked to organize their data and present their investigation to the whole group. This time, teams should choose another form of presentation. (For example, in a classroom with children the students may have the opportunity to present their investigations as in a science fair, construct PowerPoint Presentations, videos, etc.)

Another type of elaboration or extension might involve the participants/students in researching how inclined planes are used in real life. This would involve outside resources (books, Internet, experts in areas such as construction or engineering, etc.). Teams of students would then present their findings to the class.

Evaluation

There are a number of ways to assess students' understanding of the concept taught. One might be to ask them to write a paragraph summarizing what they learned from their original investigation. Invite them to illustrate their paragraph with sketches or diagrams.

Inquiry Data Sheet

The question: How does the height of the inclined plane affect the distance a marble or other round object will roll?

We predict (our hypothesis is):

The materials we used:

The steps we followed (our procedure is):

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

The observations we made (my data are):

The answer to the question (our conclusion is):

What are characteristics of effective homework in mathematics?

- **The home should be a place to extend mathematics learning.**

Research and Best Practice

Daily, children hurry home from school and arrive to face the obligatory question from parents, “What did you learn in school today?” They return to school the following day, and their teacher asks, “Do you have your homework assignment?” Perhaps a better question would be “What did you learn at home?” The home should be a place to extend mathematics learning.

Student learning in mathematics should always focus on understanding the set of skills and knowledge needed to investigate the world. Homework must emphasize developing students’ mathematics skills to solve problems, which will help them understand the world. These mathematics skills are described as “process skills” in the *NCTM Principles and Standards for School Mathematics* and “habits of mind” in *Benchmarks for Science Literacy*. Mathematics educators and mathematicians agree that knowing mathematics is more than being able to recall facts. Research indicates that individuals with expertise in mathematics understand mathematics concepts, how to apply them to challenging, non-routine real-life problem-solving situations, and how to learn from their own problem-solving efforts.

Homework assignments provide the opportunity for students to do long term projects that require multiple levels of understanding. Students take ownership when they spend weeks following stock prices in the newspaper, paying close attention to favorites, predicting industry trends, interviewing traders, or perhaps even participating in an investment club. Watching TV and timing commercial breaks one night may be interesting, but when students keep data over a few weeks — timing commercials in different types of programs, making charts, and drawing graphs — their learning will go beyond the curriculum.

Homework time is an opportunity for students to reflect on learning and synthesize their mathematics understandings. Well-designed homework can bring parents and other adults into a student’s community of mathematics learners. Assignments should include students discussing their learning with others. This can be done through student learning teams, parent involvement, or the teacher using e-mail to have discussion groups. Mathematics is in every aspect of life. Teachers should take advantage of the opportunity to provide students with authentic learning opportunities at home.

Excerpted from
EDThoughts: What We Know About Mathematics Teaching and Learning. © 2001 McREL. Reprinted with permission.

Classroom Implications

The value placed on various aspects of mathematics learning can be seen in the allocation of instructional time in class and by the nature of homework assigned. Teachers who value problem-solving skills will provide time in class to develop students' ability to solve problems and then will assign homework that uses these skills in new settings. What goes on in class should match the homework assigned.

Mathematics homework should not be schoolwork done at home. The home provides a unique opportunity for students to gain mathematics understanding by solving mathematics problems. Placing the major emphasis on basic skills and drill for skill development in mathematics is somewhat of a waste of student, parent, and teacher time and effort.

Teaching for understanding requires carefully designed tasks. Homework assignments should have clear criteria and/or written rubrics that describe expectations and establish student goals. The teacher must be certain that students have access to the materials and resources they will need to complete the assignment.

It is important for students to do their best, and for teachers to examine student work. Less is often more when it comes to homework. A product that has been refined by the student results in more effective learning than a large volume of work completed with little thought. The quality of student work is often determined by the standards a teacher sets on the assignment, time spent reviewing the expectations, and suggestions for improvements. A homework assignment should be a major event in student learning. Selling students on the importance of an assignment as a learning event is important: their ownership will determine the depth and breadth of their learning.

References

American Association for the Advancement of Science, Project 2061. (1993). *Benchmarks for science literacy*.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*.

National Science Foundation. (1999). *Inquiry thoughts, views, and strategies for the K–5 classroom*.

Perkins, D. (1993). *Learning for understanding*.

- **Mathematics homework should not be schoolwork done at home.**

To obtain copies of EDThoughts:

What We Know About Mathematics Teaching and Learning, contact McREL at 303-337-0990 (voice), 303-337-3005 (fax), or info@mcrel.org

What are characteristics of effective homework in science?

- A homework assignment should be a major event in student learning.

Research and Best Practice

Every day children hurry home from school and arrive to face the obligatory question from parents, “What did you learn in school today?” They return to school the following day, and their teacher asks, “Do you have your homework assignment?” Perhaps a better question would be “What did you learn at home?” The home should be a place to extend science learning.

Student learning in science should always focus on understanding the set of skills and knowledge needed to investigate the world. Science knowledge is growing too quickly to learn it as a body of knowledge. We must rely on developing students’ science skills to do investigations, which will help them understand the world. These science skills are described as “inquiry” in the *National Science Education Standards* and “habits of mind” in *Benchmarks for Science Literacy*. Science educators and scientists agree that knowing science is more than being able to recall facts. Research indicates that individuals with expertise in science understand science concepts and how to learn from their own investigations and inquiry.

Homework assignments provide the opportunity for students to do longterm projects that require multiple levels of understanding. Students take ownership when they spend months observing an ecosystem, finding the names of organisms in an environment, suggesting ways to maintain diversity in that environment, interviewing wildlife managers and perhaps even taking action to protect the environment. Observing the night sky on one night may be interesting, but when students keep a night sky journal for six months — drawing diagrams, tracing movements, and identifying objects in the sky — their learning will go beyond the curriculum.

Homework time is an opportunity for students to reflect on learning and synthesize their science understandings. Well-designed homework can bring parents and other adults into a student’s community of science learners. Assignments should include students discussing their learning with others. This can be done through student learning teams, parent involvement, or the teacher using e-mail to have discussion groups. Science is in every aspect of life. Teachers should take advantage of the opportunity to provide students with authentic learning opportunities at home.

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The value placed on various aspects of science learning can be seen in the allocation of instructional time in class and by the nature of homework assigned. Teachers who value investigation skills will provide time in class to develop students' ability to do investigations, and then will assign homework that uses these skills in new settings. What goes on in class should match the homework assigned. Science homework should not be school work done at home. The home provides a unique opportunity for students to gain science understanding by doing science investigations.

Teaching for understanding requires assignments designed for understanding. Assignments should have clear criteria and written rubrics that describe expectations and establish student goals.

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Getting students involved in science news events helps students understand the nature of science. Students should be aware, curious, and interested in newsworthy events such as a solar eclipse, shuttle launch, or the discovery of a new gene therapy. Connecting newsworthy science events to the science learning in school helps students take an important step toward science literacy.

The public is fascinated with science and nature. PBS science programs such as "Nature," "Nova," and "National Geographic Explorer" should be part of a student's life. Teachers should encourage students to watch specific educational programs that connect with their science learning. As homework, students can watch and discuss specific educational television programs with their parents and fellow students. School time is far too precious to spend watching a video.

References

- American Association for the Advancement of Science, Project 2061. (1993). Benchmarks for science literacy.
- Chiappetta, E. (1997). Inquirybased science.
- National Science Foundation. (1999). Inquiry thoughts, views, and strategies for the K-5 classroom.
- Perkins, D. (1993). Learning for understanding.
- Sachse, T. P. (1989). Making science happen.

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Inquiry Notes

Assessment Strategies

Assessment Resource Pages

Two Basic Outcomes for Assessment

Formative—Formative assessment is ongoing through the course of instruction. The intent is to evaluate the progress of learning. Modifications in instruction, correction of misunderstanding, and emphasis of under-developed concepts are the outcome of this type of assessment.

Summative—Summative assessment evaluates the final outcome of instruction. It is used for final evaluations.

Two Basic Methods for Assessment

Informal—Informal assessment usually involves personal interaction between teacher and student. Monitoring the responses from whole group discussion and keying in on individuals through carefully used questions provides the teacher with important feedback. Moving from student to student asking them to explain important concepts exemplifies this type of assessment. Summaries, quick question responses (both oral and written), hand signals, analogy prompts, creating flow charts or timelines, responding to misconception checks, all of these and more can be effective ongoing assessment of student understanding.

Formal—Formal assessment calls for responses to specific questions or tasks. Generally some written form of response is required so as to document understanding.

Common Forms of Formal Assessment

Multiple Choice—Multiple choice assessments target important content. Items include a stem (a simple statement or question which presents a problem or task to the student) and options (responses to the stem from which students choose the correct or best answer).

Open Response—Open response questions allow students to construct a response that demonstrates their understanding of important concepts. Students respond to a prompt (a statement designed to assess a targeted academic expectation with directions for student response) and their response is evaluated based on a criteria established in a scoring guide (a rubric designed to evaluate the quality of the student response).

- **Formative**
- **Summative**

- **Informal**
- **Formal**

- **Multiple Choice**
- **Open Response**
- **Performance Task**



Performance Task—Performance task questions allow students to both show and apply what they have learned. Students respond to a prompt. Performance of some kind of hands-on task is required. Students then answer questions about the product. Their response, including the product, is evaluated based on criteria established in a scoring guide (rubric).

Multiple Choice Assessment Item

Directions

Use the box of minerals labeled A, B, C, and D, and the hand lens to help you answer the following question.

Stem

On which of the following minerals can you make a visible scratch mark with your fingernail?

Options

- A. fluorite
- B. gypsum
- C. quartz
- D. calcite

Scoring Key

- B. gypsum

Rationale

Students are to categorize rocks and minerals according to observed properties, which include hardness. This question employs the process of investigation by performing a scientific behavior and evaluating the results.

Open-Response Assessment Item

Prompt

A scientist removed a one-liter sample of water from the Pacific Ocean and brought it to Utah. After studying the water sample, the scientist poured the water into the gutter along the road outside the lab. Explain the processes of evaporation, condensation, precipitation, and run off. Explain how these processes are involved for at least one drop of this water to return to the Pacific Ocean and how each process leads to the next.

Scoring Guide

SCORE	DESCRIPTION
4	The response shows a complete understanding of the processes of evaporation, condensation, precipitation, and run off and how these processes relate to one another.
3	The response shows a complete understanding of the processes of evaporation, condensation, precipitation, and run off but an incomplete understanding of how these processes relate to one another.
2	The response shows a limited understanding of the processes of evaporation, condensation, precipitation, and run off and a minimal understanding of how the processes relate to one another.
1	The response shows a minimal understanding of the processes of evaporation, condensation, precipitation, and run off and little or no understanding of how the processes relate to one another.
0	The response is totally incorrect or irrelevant
BLANK	Blank/no response

Rationale

This question assesses the student’s understanding of the stated processes and how they relate to one another. The question allows students to demonstrate a diversity of conceptualization since there are a variety of appropriate scientific scenarios to accomplish the task set forth.

Performance Task Assessment Item

Prompt

Accurately identify each of the sample materials in the containers before you. Use the materials to construct a scientifically correct mock soil profile in your plastic vial. Make a drawing of your soil profile and explain the science reasons why you constructed the soil profile as you did.

Scoring Guide

SCORE	DESCRIPTION
4	The response accurately identifies each of the sample materials of gravel, sand, silt or clay, and organic matter. The construction, drawing, and explanation show an accurate and thorough understanding of the composition of a soil profile and are consistent with each other.
3	The response accurately identifies each of the sample materials of gravel, sand, silt or clay, and organic matter. The construction, drawing, and explanation show a mostly accurate and at least partial understanding of the composition of a soil profile. There may be some minor inconsistencies as they relate to one another.
2	The response accurately identifies at least three of the sample materials of gravel, sand, silt or clay, and organic matter. The construction, drawing, and explanation show some understanding of the composition of a soil profile, but may contain significant inconsistencies as they relate to one another.
1	The response accurately identifies at least one of the sample materials of gravel, sand, silt or clay, and organic matter. The construction, drawing, and explanation, show minimal or inaccurate understanding of the composition of a soil profile.
0	The response is totally incorrect or irrelevant
BLANK	Blank/no response

Rationale

The tasks involved demonstrate some recall, but invite the student to reach into higher levels of comprehension and analysis.

General Guidelines for Creating a Scoring Guide (Rubric)

SCORE	DESCRIPTION
4	<ul style="list-style-type: none"> • Follows all directions and finishes all parts of the question. • Answers the question clearly so that others can understand. • Shows complete understanding of the information requested. • Shows and/or explains the quickest and best way to get an answer. • Shows and explains what knowledge using complex examples, by showing connections between ideas and the real world, by comparing different ideas, and/or by showing how the ideas work together.
3	<ul style="list-style-type: none"> • Follows the directions and finishes most of the parts of the question. • Answers the question clearly so that other can understand. • Shows and/or explains understanding of the big ideas about the question but there are a few little mistakes or wrong ideas.
2	<ul style="list-style-type: none"> • Follows some of the directions and finishes some parts of the question. • Answer may not be complete but it is clear enough so that others can understand. • Shows understanding of only parts of the information necessary to answer the question.
1	<ul style="list-style-type: none"> • Understands only a small part of the information asked for in the question. • Answers only a small part of the question.
0	<ul style="list-style-type: none"> • The response is totally incorrect or irrelevant.
BLANK	<ul style="list-style-type: none"> • Blank/no response

Additional Resources

Understanding by Design by Grant Wiggins and Jay McTighe

Help with designing evaluation rubrics: <http://rubistar.4teachers.org>

Assessment Strategies Notes

Assessment Strategies Notes

Misconceptions

Misconceptions

Misconceptions have been referred to as misunderstandings, misleading ideas, non-scientific beliefs, misinterpretations of facts, preconceived notions—you get the idea. In most cases, when a person has developed a misconception, they are unaware that their ideas are incorrect. What is of even more concern is that they continue to build knowledge on their current understandings. Having misconceptions can have serious impacts on learning. People work very hard to process information and arrive at their ideas. It takes just as much work to let go of the misconceptions and reconstruct new ideas.

“After a lifetime of learning, students graduate from college with the same misconceptions they had upon entering grade school. Every time we communicate, new concepts compete with the preconceived ideas of our listeners. All students hold these ideas, but they are unaware of their private theories. We must make them aware. Only then can we enable them to learn and free them from this ‘Private Universe’.”

From the video “A Private Universe; Misconceptions That Block Learning.”

Produced at the Harvard-Smithsonian Center for Astrophysics.

Distributed by: The Astronomical Society of the Pacific
390 Ashton Ave.
San Francisco, CA 94112

Examples of common misconceptions:

Grade 3

Misconception: Wool clothing produces heat.

The loose fibers of the wool clothing trap your body heat and make you feel warmer.

Grade 4

Misconception: Both steam and clouds are water as a gas.

If you can see it, it is a solid or a liquid, not a gas.

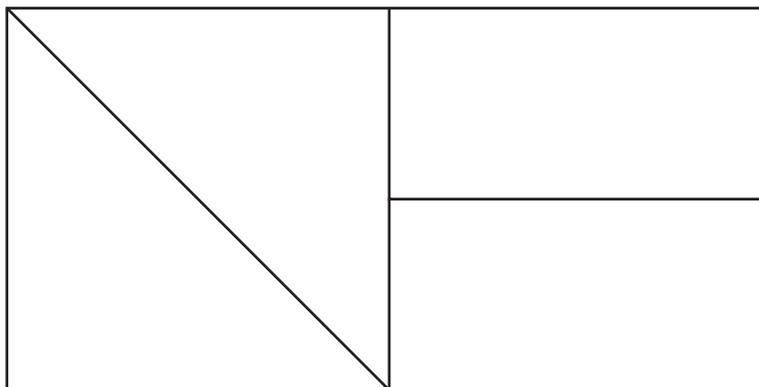
Misconception: A larger number cannot be subtracted from a smaller number.

5 - 8 = -3 Draw a number line and prove this misconception.

- **After a lifetime of learning, students graduate from college with the same misconceptions they had upon entering grade school.**

Misconception: The four pieces of this rectangle are not equal shares.

Cut/tear a rectangular piece of paper to prove your theory.



Misconceptions Notes

Misconceptions Notes

Journaling Ideas

Journaling

Background Information

Science and math concepts have been compared to a brick building where, course by course, each brick provides the cement foundation for the information that is to follow. The foundation of radioactivity research was the life work of the great French physicists, Pierre and Marie Curie. Madame Curie's carefully preserved journals minutely detailed step-by-step the process of their work which has become the basis for innumerable advancements in science.

Purdue University research focused on using children's journals as a tool for teaching, learning, and assessing science. The findings showed that journals were valuable in teaching communication and literacy techniques during science lessons. Journals also provided documentation that students had a better understanding of scientific concepts and had begun an inquiry-based self-learning process.

It is vital to introduce student journals at the elementary school level to create the habit of journaling as a lifelong learning tool. Both formal and informal journaling models have been found to be equally effective. Journaling experiences are described in *Jordan School District Science TRB*³ as:

1. Drawing pictures and labeling them
2. Writing short paragraphs about observed changes and interactions
3. Noting reactions to different stimuli
4. Making predictions
5. Recording observations
6. Analyzing reasoning
7. Keeping measurements
8. Comparisons

1. **Drawing pictures and labeling them**
2. **Writing short paragraphs about observed changes and interactions**
3. **Noting reactions to different stimuli**
4. **Making predictions**
5. **Recording observations**
6. **Analyzing reasoning**
7. **Keeping measurements**
8. **Comparisons**

Journaling Examples

From *Dinah Zike's Big Book of Books and Activities*

1. Layered Look Book p. 70-78
2. Pop-Up Book p. 112-115 *Remember the rule—*Always* cut on a fold, and *Never* glue on a fold.
3. Top Tab Book p. 80-83
4. Pyramid Book p. 38-41
5. Circle Book p. 64-65

Materials

- scissors
- paper
- glue sticks
- markers
- staplers and staples

Additional Resources

Jordan School District Science TRB3

Dinah Zike's Big Book of Projects, by Dinah Zike (M. Ed.)

Big Book of Books and Activities, by Dinah Zike (M. Ed.)

Journaling Notes

Journaling Notes

***Math
Standard I
Activities***

Activity—Math in My World

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.

Objective 5

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

Intended Learning Outcomes

4. Communicate mathematically.
5. Make mathematical connections.

Standard

I

Objectives

3 & 5

Connections

Background Information

Number sense can be described as a good intuition about numbers and their relationships. It develops gradually as a result of exploring numbers, visualizing them in a variety of contexts, and relating them in ways that are not limited by traditional algorithms. No substitute exists for a skillful teacher and an environment that fosters curiosity and exploration at all grade levels.” Hilde Howden, *Arithmetic Teacher*, Feb. 1989

Children with good number sense pay attention to numbers and know how numbers relate to each other. They know the cardinal and ordinal numbers and can define numbers in several ways. For example, 12 may be defined as 12 ones, 1 ten + 2 ones, $6 + 6$, 3×4 , and so on. Children with good number sense can compare the relative sizes of numbers. They know that 51 is smaller than 100, much larger than 2, and about the same as 49. They also understand the effect of operations on numbers—that addition results in larger number and subtraction results in a smaller number. Children develop number sense first by manipulating objects, then by using language to explain their thinking.

Invitation to Learn

Read *Math in the Bath*.

Instructional Procedures

1. Have students brainstorm a list of all the many and varied ways in which mathematics is part of their world and record it in their math journals.

Materials

- Math in the Bath*, by Sara Atherlay (Simon and Schuster)
- Mathematics Journal Cover Page
- Problem Solving Strategies
- Example of student created poster

2. Students will record the shared ideas as their first journal entry. The entry should include:
 - *Date:*
 - *Problem Solving Strategy:* Brainstorming.
 - *Today's Challenge:* List all the many and varied ways in which mathematics is part of my world. (Suggestions: month, date and year born; weight; height; people in family; telephone number; pets; address; zip code; age; year started school; number of books owned; library card number).
3. Closure: Show the students poster examples.

Possible Extension/Adaptations/Integration:

Students may use their list of ways math is part of their world and classify the items into categories. The teacher may suggest categories, such as Math at School, Math in After School Activities, Math at Home, Math at the Store, etc. This could be an additional journal entry teaching the students the problem solving strategy of making an organized list.

Students may make a poster entitled “Math In My World” showing ways math is all around them.

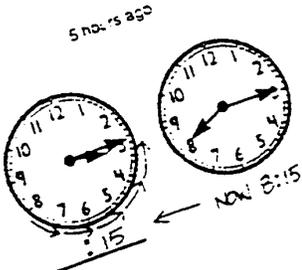
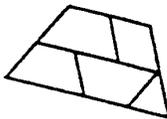
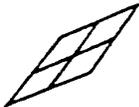
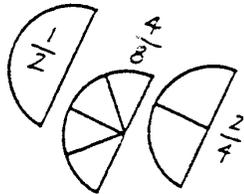
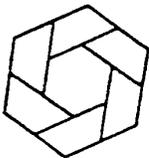
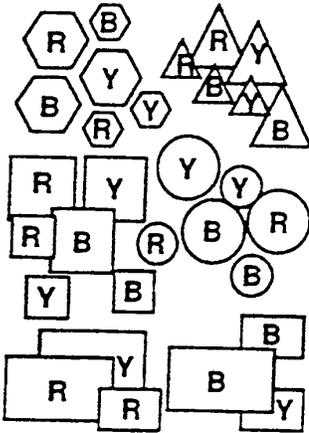
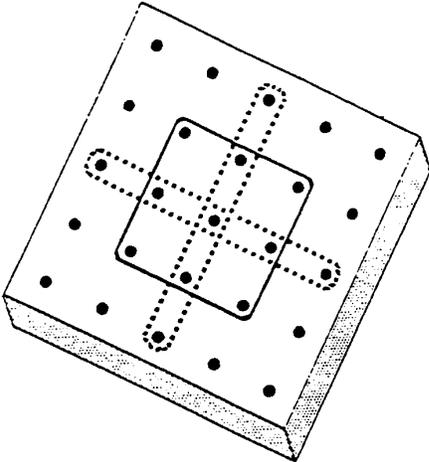
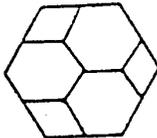
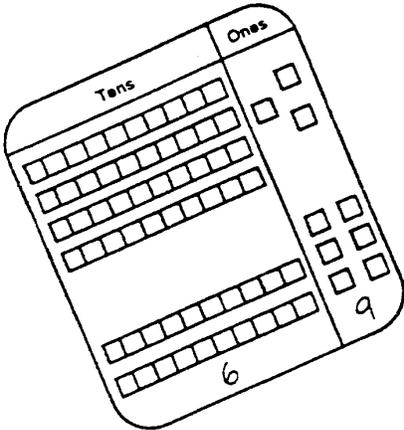
Students could create their poster using the computer program, “Inspiration.”

Additional Resources

Math Man by Teri Daniels (Orchard)

There are many math problems at the local supermarket. Helps students make the connection of mathematics to the real world.

My Mathematics Journal

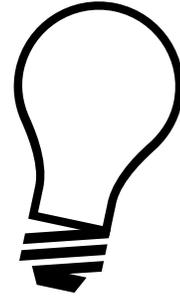


Name _____

Grade Level _____

School _____

Problem Solving Strategies



1. Act it out or use objects.
2. Draw a picture or a diagram.
3. Use or make a table, chart, or graph.
4. Make an organized list.
5. Guess and check.
6. Use or look for a pattern.
7. Work backwards.
8. Use logical reasoning.
9. Brainstorm.
10. Make an equation.

Steps for Problem Solving

1. Read the problem and look for key words.
2. Underline necessary information.
3. Ask WHY these items are important.
4. Choose a strategy to solve the problem.
5. Solve the problem.
6. Evaluate and check for accuracy.

Word Problem Strategies (TIPS)

1. T = think, read twice, thought? (add, subtract, multiply, divide, or a combination)
2. I = important information
3. P = problem or equation
4. S = solution sentence

Does your answer make sense?

Activity—Unifix Cubes

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.

Objective 5

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

Intended Learning Outcomes

1. Demonstrate a positive learning attitude toward mathematics.
2. Become mathematical problem solvers.
3. Reason mathematically.
4. Communicate mathematically.
5. Make mathematical connections.
6. Represent mathematical situations.

**Standard
I**
**Objectives
1 & 5**
Connections

Background Information

In grades 3-5, students' development of number sense should continue with a focus on multiplication and division. Their understanding of the meanings of these operations should grow deeper as they encounter a range of representations and problem situations, learn about the properties of these operations and develop fluency in whole number computation.

Students are often taught to add, subtract, multiply, and divide symbolically without looking at patterns. In these lessons, students use the unifix cubes and unifix flash cards as a visual tool to recognize and learn patterns. When they have explored patterns on their unifix flash cards, then they connect these patterns to mental math strategies and to symbolic notation. Next, connections are made to these same concepts utilizing a different model referred to as "Roll-ups."

By incorporating the process standards students learn patterns and strategies they can use to solve other problems.

Students should already understand addition and subtraction fact families.

Materials

- Unifix cubes
- Plastic cup for each student
- Touch bell
- Card with symbols + and –
- Student math mat (piece of laminated construction paper)
- Digits 0 – 9 in a set. One set for every three students.

Instructional Procedures

1. The teacher says: “I would like each of you to count out 7 unifix cubes. Next, I want you to place some of them in your left hand and some of them in your right hand and be ready to report your data, out loud together. When you hear the signal “report,” you will say in this way: “I have three plus four equals seven.” Report your data out loud. Report. Reorganize your data (pause)... get ready to report (pause)... report. etc.
2. Follow the same procedure, but this time ask your students to add and subtract unifix cubes from their mat by listening to a bell and watching for the symbol to tell them what operation to perform. Repeat for mastery.

Possible Extensions/Adaptations

Introduce overheads for mental math skills. Have students look for friendly combinations of numbers (e.g., numbers that make 10, or doubles).

Assessment Suggestion

Students may play the game “Salute.” Students will work in groups of three. One child is the General. The General shuffles the cards (digits 0-9). The other two children draw one card from the General and hold it against their chest, without looking at it. When the General says, “Salute”, the two children with cards put their card on their forehead so the General and the other child can see it. The general adds the two numbers together, using mental math skills and they says the sum. The first child to identify their own number, is the winner of that round and they gather both cards and set them in a pile. The child that has accumulated the greatest number of cards at the end of play is the winner. The children take turns being the General.

Encourage Mental Math Skills

5	1	5	9	4	1	4	6	1	9	4	5
9	7	3	8	8	9	7	6	3	6	5	7
8	6	6	7	5	2	8	3	2	7	6	8
4	2	2	3	2	8	6	4	4	4	7	9
6	4	8	2	3	3	3	7	8	5	8	4
2	3	6	4	4	7	1	7	7	2	3	5
3	1	4	5	7	4	9	8	9	3	4	6
5	8	7	1	8	6	4	1	8	8	5	7
7	2	9	2	9	5	7	6	9	9	6	8
1	6	1	7	8	9	2	6	6	3	7	9
3	1	6	8	7	2	5	4	7	4	9	8
4	7	4	9	6	1	6	9	5	4	3	2
2	9	6	5	3	6	7	9	6	5	5	4
1	8	6	6	4	3	3	5	4	9	7	6
6	3	9	3	5	2	2	8	5	1	9	7
7	4	7	2	8	9	1	8	6	7	6	4

Salute

Materials

- 10 cards per team

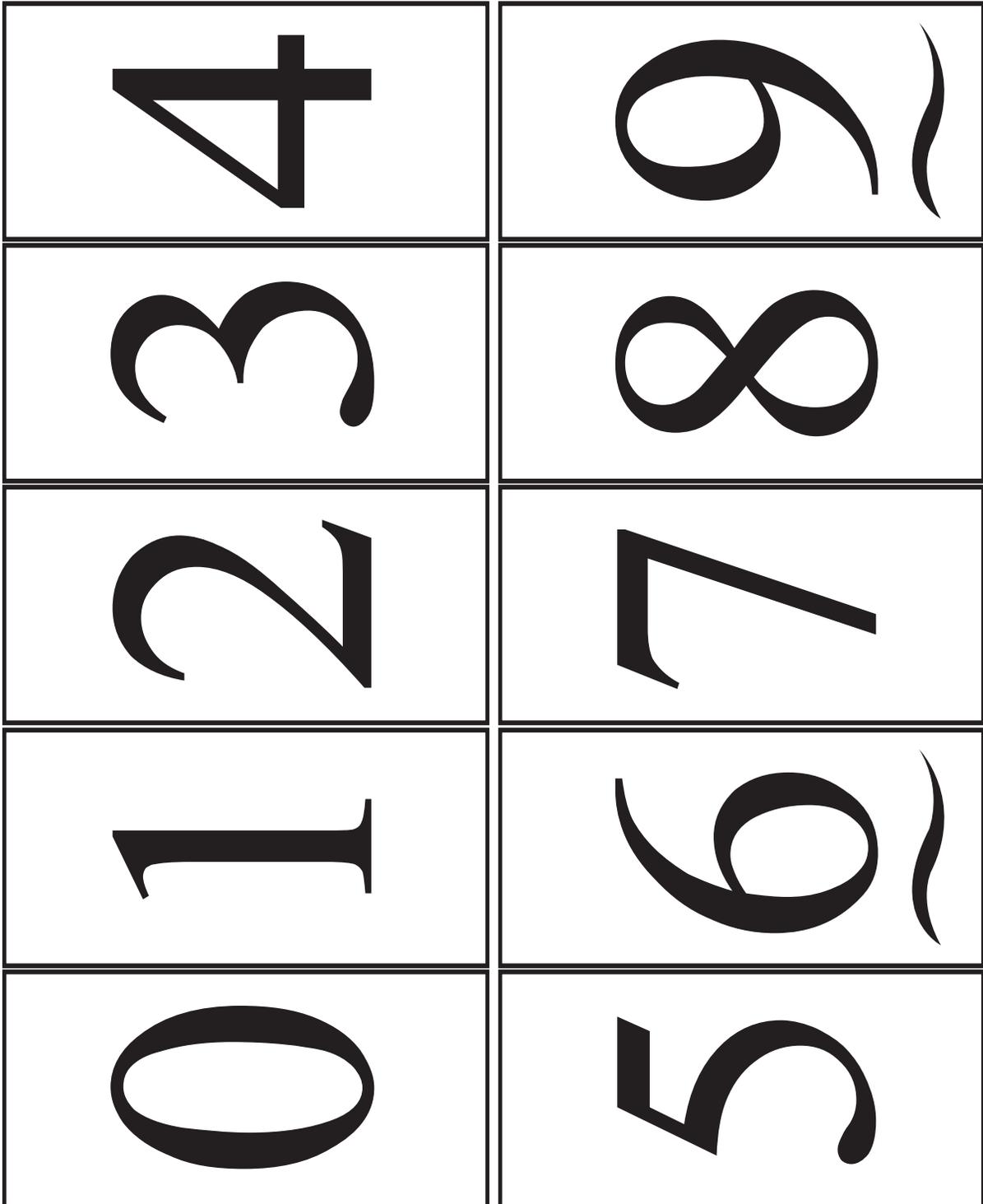
Players

3

Procedures

The “general” shuffles the ten cards, holds them face down, and instructs the two “privates” to choose a card and not to look at it. When the general gives the command to “salute,” each of the privates will salute (bring the card up to their forehead) without looking at their own card. The general tells them the product or the sum. By looking at the card of the opponent, each private determines the value of his or her own card. The first private to answer with the correct value of their own card wins both cards. The players keep playing until the general’s cards are all gone. The private with the most cards becomes the new general.

Salute Cards



Unifix Flash Cards

									10
									9
									8
1									7
	2								6
		3							5
			4						

									10
									9
									8
1									7
	2								6
		3							5
			4						

Activity—Unifix Flash Cards

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.

Objective 5

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

Standard I

Objectives 3 & 5

Connections

Invitation to Learn

- Ask your students, “How are addition, multiplication, subtraction, and division related?”
- Read a chapter from $2 \times 2 = BOO!$ which correlates to the multiple for discussion.

Instructional Procedures

1. The teacher will demonstrate how to use the unifix flash cards to build a model, showing the relationship between adding and multiplying.
2. As prior experience, students should have built 1’s, 2’s, and 3’s.
3. Say, “Cover one group with one unifix cube. One group, with one unifix cube equals one unifix cube.”
4. Students will sing about the multiples and the teacher will follow-up with questions such as: “We are singing about the multiples of *, if we have a product of *, what are our factors?”
5. The students will investigate and record their discoveries as they build additional models and write their representations.
6. The teacher will demonstrate the relationship between repeated addition and multiplication.
7. The students will investigate and record their discoveries as they build additional models and write their representations.
8. The teacher will demonstrate how to use the unifix flash cards to build a model, showing the relationship between repeated subtraction and division.
9. The students will investigate and record their discoveries as they build additional models and write their representations.

Materials

- ❑ $2 \times 2 = BOO!$ by Loreen Leedy (Holiday House)
- ❑ Four copies of the unifix flash cards, copied on cardstock or construction paper (Resource F)
- ❑ Unifix blocks or link-er-cubes (approximately 50 per student)
- ❑ Ten copies of overhead unifix flash cards, cut out
- ❑ Whiteboard or chalkboard
- ❑ Approximately 100 Unifix cubes per student
- ❑ Colored pencils
- ❑ Copy of songs to connect to the multiples (overhead copy very helpful)

10. Encourage students to see that one way to show a pattern is to write a number sentence, or use numerical notation.

Possible Extensions/Adaptations/Integration

This procedure should be revisited periodically and systematically to help students achieve mastery with each of the multiples through ten times ten, related division facts, and the ability to describe their method.

Homework & Family Connections

After working with these unifix flash cards in math class, have the students take the cards home and have the student “teach” someone in their family how to use the unifix flash cards. The family member will sign the envelope, indicating that they have worked together to enhance their mathematical understanding.

Assessment Suggestion

Response item for student journals:

Students will draw and label one of the fact family members, showing the relationship between repeated addition and multiplication and repeated subtraction and division.

Possible Extensions/Adaptations/Integration

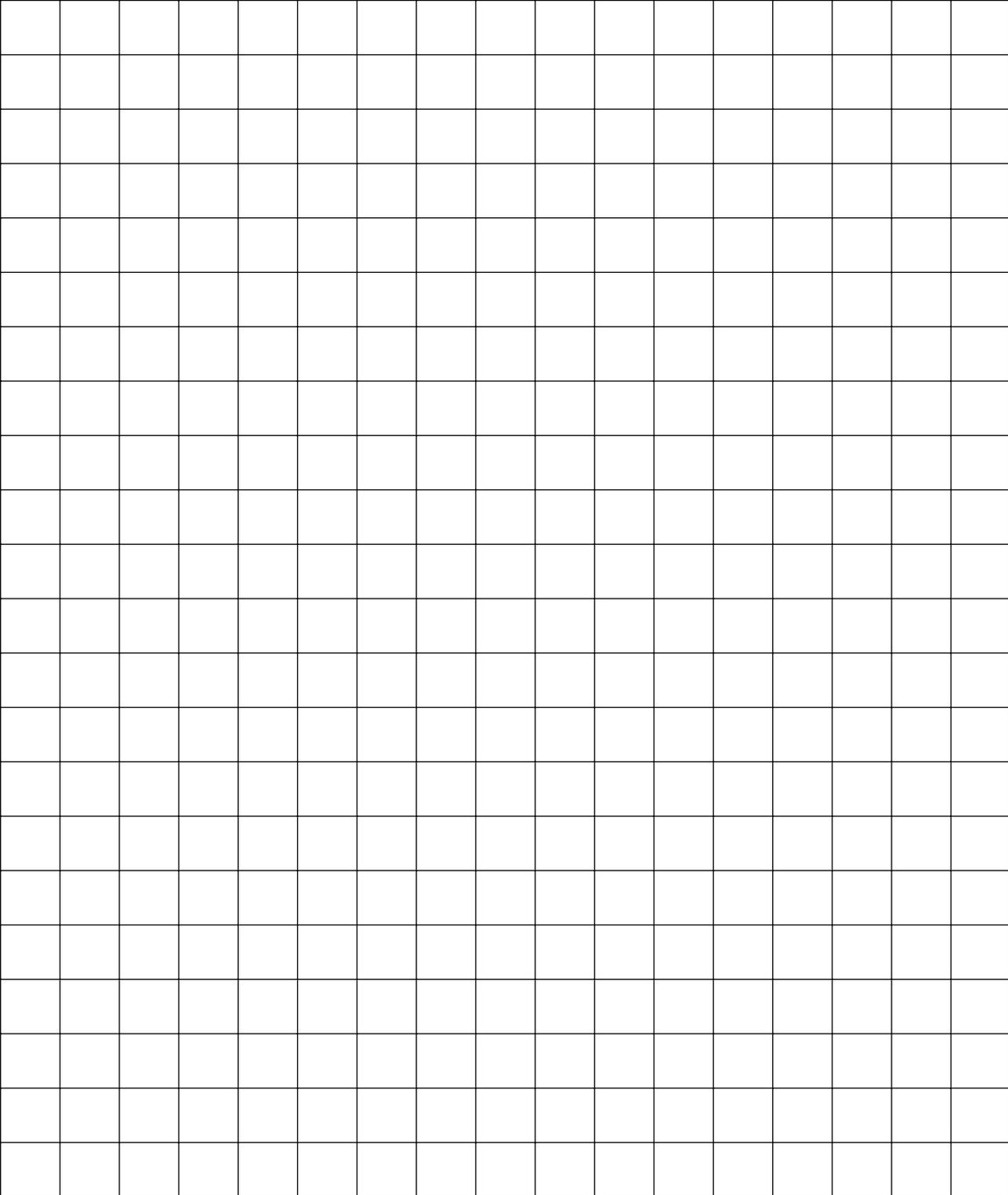
Students will make a vocabulary entry in their mathematics journal.

Students will create an array a day, both with rectangles and with dot arrays.

Standard 1: Number and Operation

Multiplication Arrays

Procedure: Read the story and have students create arrays of numbers in various ways.



Name: _____

Fact Power Table/Dot Array Sheet

Draw an array for each multiplication fact in the table. Write the product.

X; ÷	1 ·	2 ..	3 ...	4	5	6	7	8	9	10
1 ·										
2 · ·										
3 · · ·										
4 · · · ·										
5 · · · · ·										
6 · · · · · ·										
7 · · · · · · ·										

8										
9										
10										

Activity–Roll-ups

Standard I

Objectives 3 & 5

Connections

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.

Objective 5

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

Invitation to Learn

Read from the picture book *What Comes in 2's, 3's and 4's?*

Remind the students of the pattern they built in the previous lesson when they discussed the multiple of ____.

Say, “Today we are going to look at the multiples of ____ with a different model than we built in our previous lesson. Today we are going to use a tool called a roll-up.”

Materials

- The Great Divide* by Dayle Ann Dodds (Candlewick Press)
- What Comes in 2's, 3's, & 4's?* by Suzanne Akere (Scholastic) In this book children will see real-life things that come grouped in different ways. It explores groupings of 2, 3, and 4.
- 10 Portion cups and 40 beans, per participant or student
- Blackline master to record division
- Blackline master of dot sheets (set includes 1's through 10's)
- Copy paper
- Glue stick

Instructional Procedures

Day 1

1. Show and demonstrate the steps to be followed to create a roll-up.
2. Students will roll the dot sheet from the bottom to the top, one row at a time.
3. Students will glue a plain sheet of copy paper to the right side of their dot paper, for multiples of five through ten. Students will also glue a plain sheet of paper on the left side of the multiples of nine and ten.
4. Students will roll both sheets carefully, from the bottom to the top.
5. Students will label the top of the dot sheet with the multiple being developed that day (start with 1's and work up to 10's) as “Multiples of _____ developed by _____ (student's name).”
6. Students will label the top of the blank sheet of paper: “Repeated Addition and Its Relationship to Multiplication”

7. Students will circle the first group of dots under the title and label it with the representation ($1 \times 2 = 2$). On the repeated addition side, the student will list the repeated addition problem ($2 + 0 = 2$).
8. Students will continue this process by unrolling one line of dots at a time and labeling them ($2 \times 2 = 4$) and label the repeated addition ($2 + 2 = 4$).
9. This process will continue until all lines of dots have been circled, labeled as multiplication, and with the relationship to repeated addition.
10. Students will investigate these patterns, utilizing the repeat function of their calculators.
11. Students will record the pattern as it appears in the window on their calculators.
12. Students will sing about each of the multiples after completing the pictorial.
13. Collect these pictorial models from the students.

Day 2

1. Students will sing the multiple songs from the previous lesson to make the transition to the division relationship.
2. Read excerpts from *Great Divide*.
3. Make division models utilizing beans and portion cups.
4. Students will make a roll-up with the dot sheet, by rolling from the bottom to the top, one row at a time.
5. Students will glue a plain sheet of copy paper to the right side of their dot paper, for divisors of five through ten. Students will also glue a plain sheet of paper on the left side of the divisors of nines and tens.
6. Students will roll sheets carefully, from the bottom to the top.
7. Students will label the top of the dot sheet with the divisor being developed that day (start with 1's and work up to 10's). "Division by _____ developed by _____ (student's name)".
8. Students will label the top of the blank sheet of paper: "Repeated Subtraction and Its Relationship to Division".
9. Students will circle each group of dots under the title and label it with the representation starting at the bottom of the dot sheet (i.e. a divisor of 8: 80 divided by 10 = 8. On the repeated subtraction side the student will list the repeated subtraction problem: $80 - 8 - 8 - 8 - 8 - 8 - 8 - 8 - 8 - 8 - 8 = 0$).

10. Students will continue this process by rolling one line of dots under, at a time and labeling them. This process will continue until all 10 lines of dots have been labeled as division and as repeated subtraction.
11. Students will investigate these patterns utilizing the repeat function of their calculators.
12. Students will record the pattern as it appears in the window on their calculators.
13. Students repeat the functions on their calculators for each of these divisors.

Pacing Recommendation

Introduce 1's, 2's, and 3's in September. Introduce 4's and 5's in October. Introduce 6's and 7's in November. Introduce 8's and 9's in December.

Possible Extensions/Adaptations

Make an array a day, and a fact power table to reinforce the multiples introduced each month.

This procedure should be revisited periodically and systematically to help students achieve mastery with each of the fact families through ten times ten and the related division facts and be able to describe their method.

Pattern Block Multiplication: Instruct student groups to use die cut pattern block pieces, or trace around pattern block pieces, to create a picture of a multiplication problem. Have students record the numerical multiplication sentence under their picture.

Assessment Suggestion

Using a number line, have students create arrays for each of the numbers along the number line.

Additional Resources

Aunty Math URL: <http://www.enc.org/redirect/dd/?dd id=1159>

Grades: K – 5

Synopsis: A visit to relatives can mean more than a pinch on the cheek and a handful of stale candy! Meet Aunty Math, the coolest aunt your students will ever love. Her Math Challenges are fun for K-5 learners and encourage the use of multiple intelligences in problem solving. Students are invited to submit their solutions to the problem, and teachers can explore the mathematics behind each challenge, see correlations to standards, and utilize suggested activity extensions (for more details see <http://www.enc.org/records/013228/>).

Books: Standard 1- Number and Operation: Addition, Subtraction, Multiplication, and Division

The Great Divide by Dayle Ann Dodds (Candlewick Press) The characters are participating in a race. With each page the group is cut in half. Helps students understand division.

Each Orange Had 8 Slices by Paul Giganti, Jr. (Greenwillow Books) This is a counting book which extends children's number sense. The children see the number but they also have to look for all the many and varied ways in which objects are grouped, and the number represented on the page.

Only One by Marc Harshman (Cobblehill.Books) This book looks at groups of items that when put together equal one. It looks at 12 eggs but it is only one dozen or a million stars but it is only one sky. This book generates ideas that help with number sense beyond just counting.

Two of Everything by L. T. Hong (Morton Grove, H: Albert Witman) An old man finds a pot as he is working. He takes it home to his wife. They discover that everything that put into the pot doubles. They are able to have lots of money and become very wealthy.

Bunches and Bunches of Bunnies by Louise Mathews (Dodd, Mead) This story begins with two bunnies and they just keep multiplying until there is bunches and bunches of bunnies.

Too Many Kangaroo Things to Do! Stuart J. Murphy (HarperCollins Publishers) It is Kangaroo's birthday and he tries to find other animals to play with him. They all tell him that they have too many things to do. Finally he goes back to his house sadly because no one will play with him. He discovers that all of his friends are at his house giving him a surprise party. Helps build student understanding of multiplication.

A Remainder of One by Elinor J. Pinczes (Houghton Mifflin) The Queen of the bugs wants the army to march in even lines. Private Joe divides them into more and more lines so that he will not be left out.

Just Add Fun! by Joanne Rocklin. (Scholastic Inc.) Develops children's understanding of multiplication.

The Hershey's Multiplication Book by Jerry Pallotta (Scholastic, Inc.) Hershey candy bars are the tool utilized by the author to help children understand multiplication concepts and multiplication representation.

Jump, Kangaroo, Jump! by Stuart J. Murphy (HarperCollins Publishers) It is Field Day for Kangaroo and his friends. There are many different events. The friends have to divide into groups to participate in the various events.

Homework & Family Connections

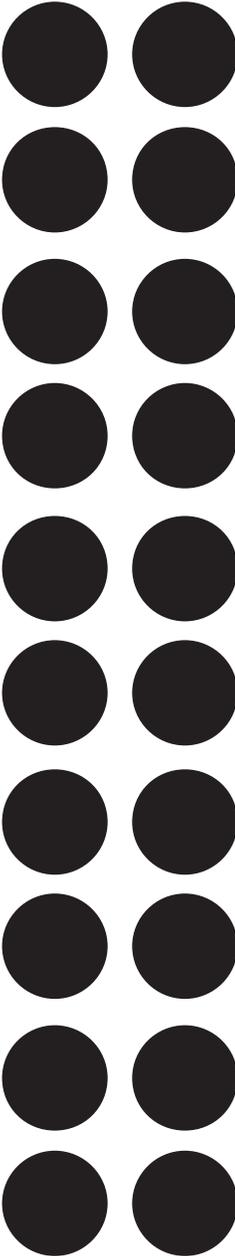
After working with these unifix flash cards in math class, have the students take the cards home and "teach" someone in their family how to use them. The family member will sign the envelope, indicating that they have worked together to enhance their mathematical understanding.

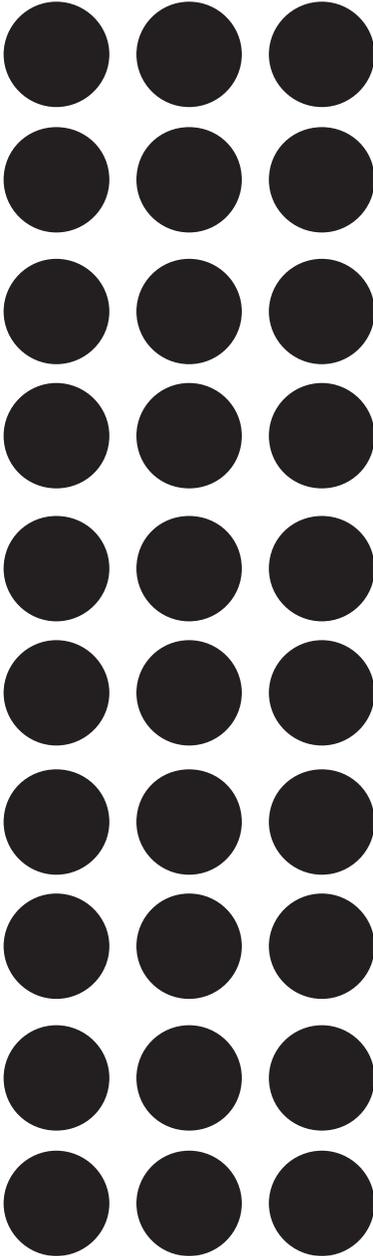
Students will use their roll-ups at home to practice visualizing multiplication and division facts.

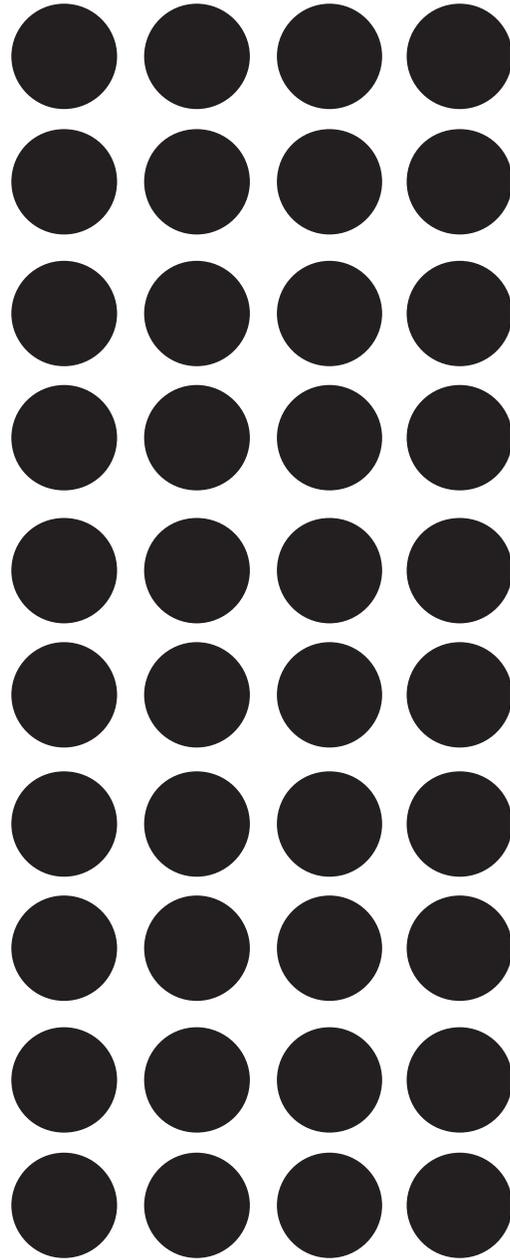
Encourage students to play any of the following mathematics related board games and card games to reinforce Mathematics Standard I Rummikub, Triple Yahtzee, Yahtzee, Contig 60, FAB, Dreidel, Tower of Brahms, Aggravation, Backgammon, Chinese Checkers, Concentration, Connect 4, Dominoes, Life, Master Mind, Match 4, Monopoly, Perfection, Risk, Stratego, UNO.

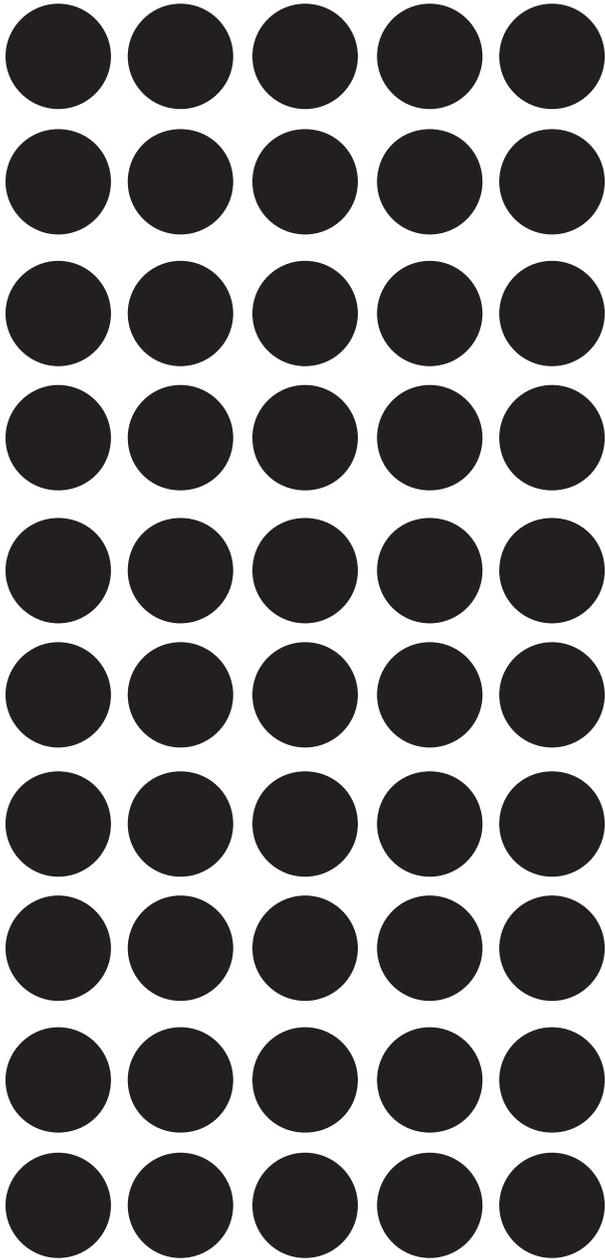
Dot Sheets

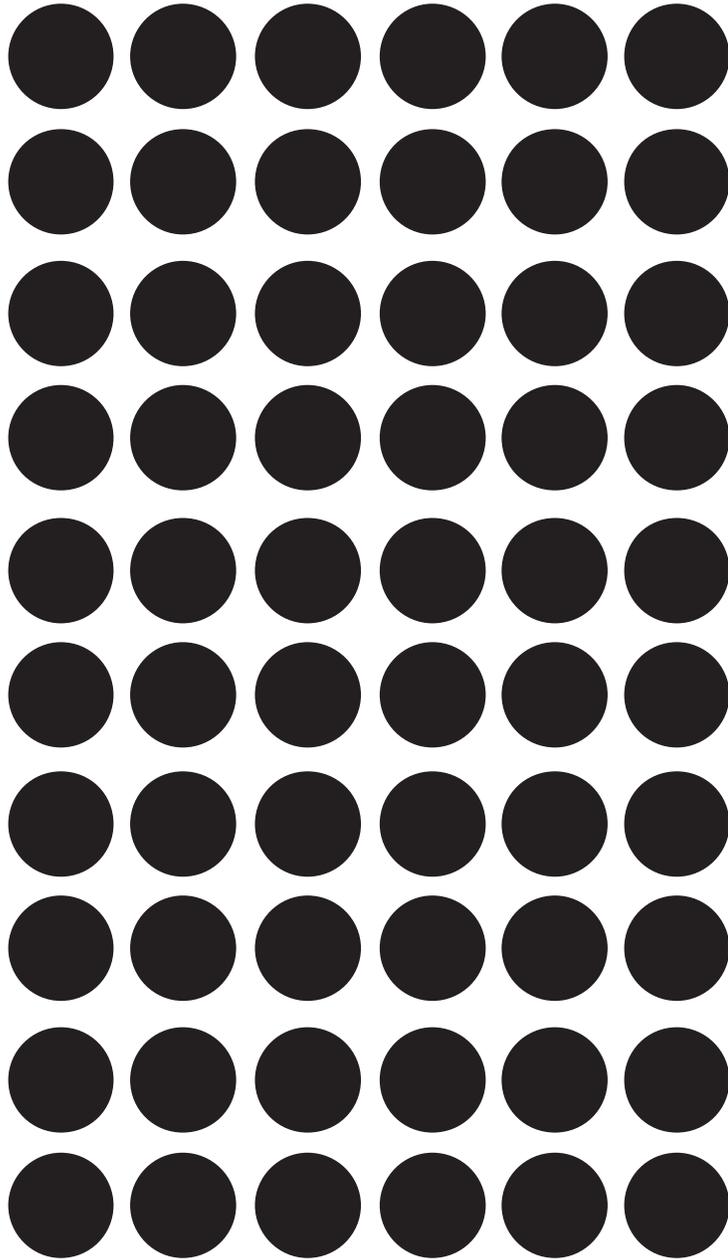


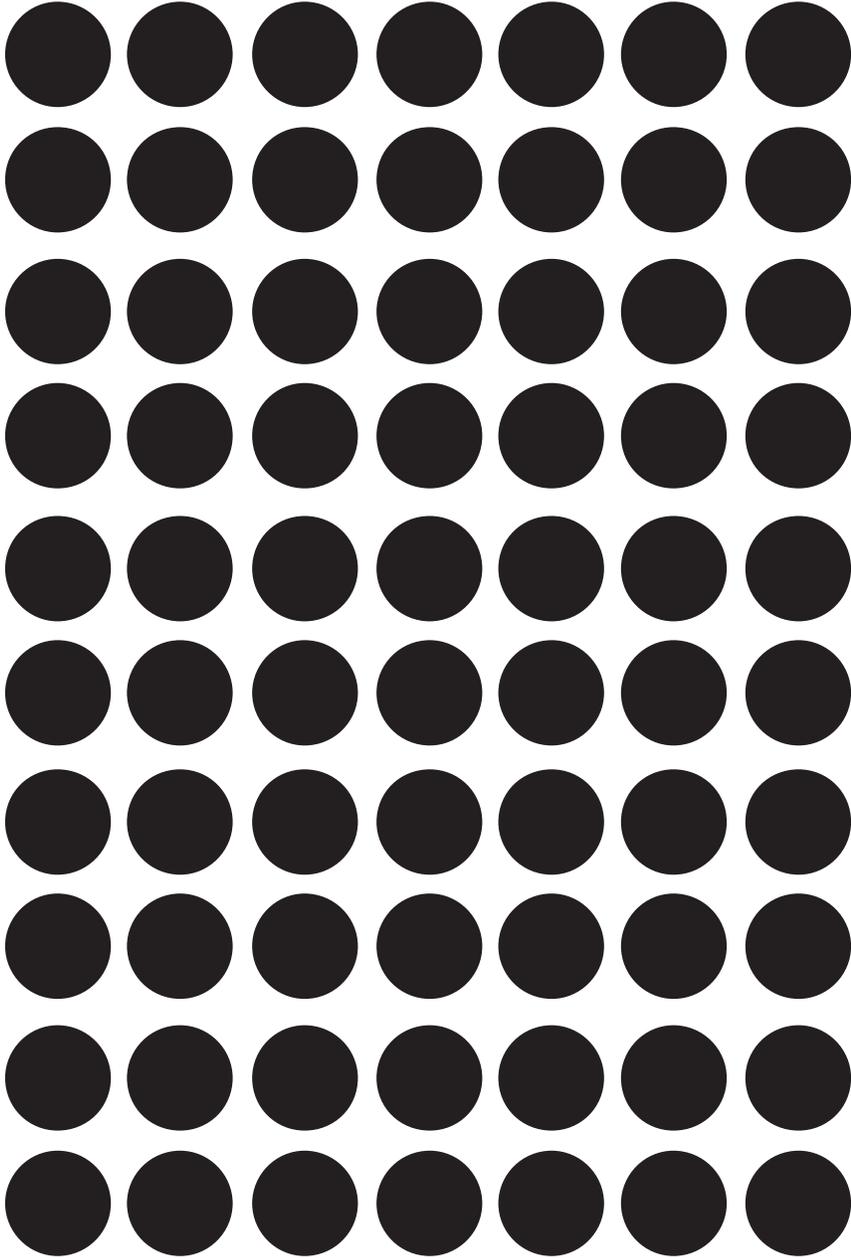


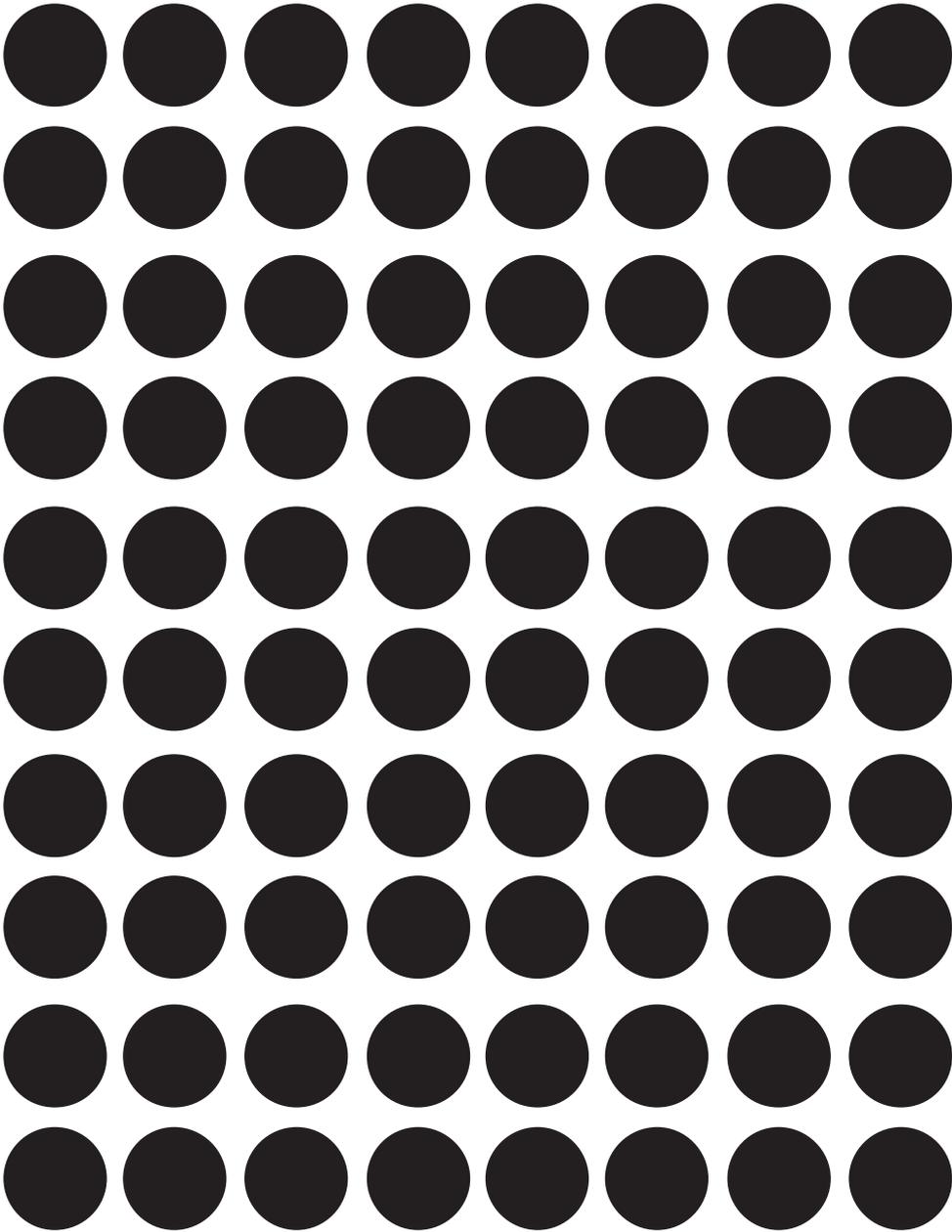


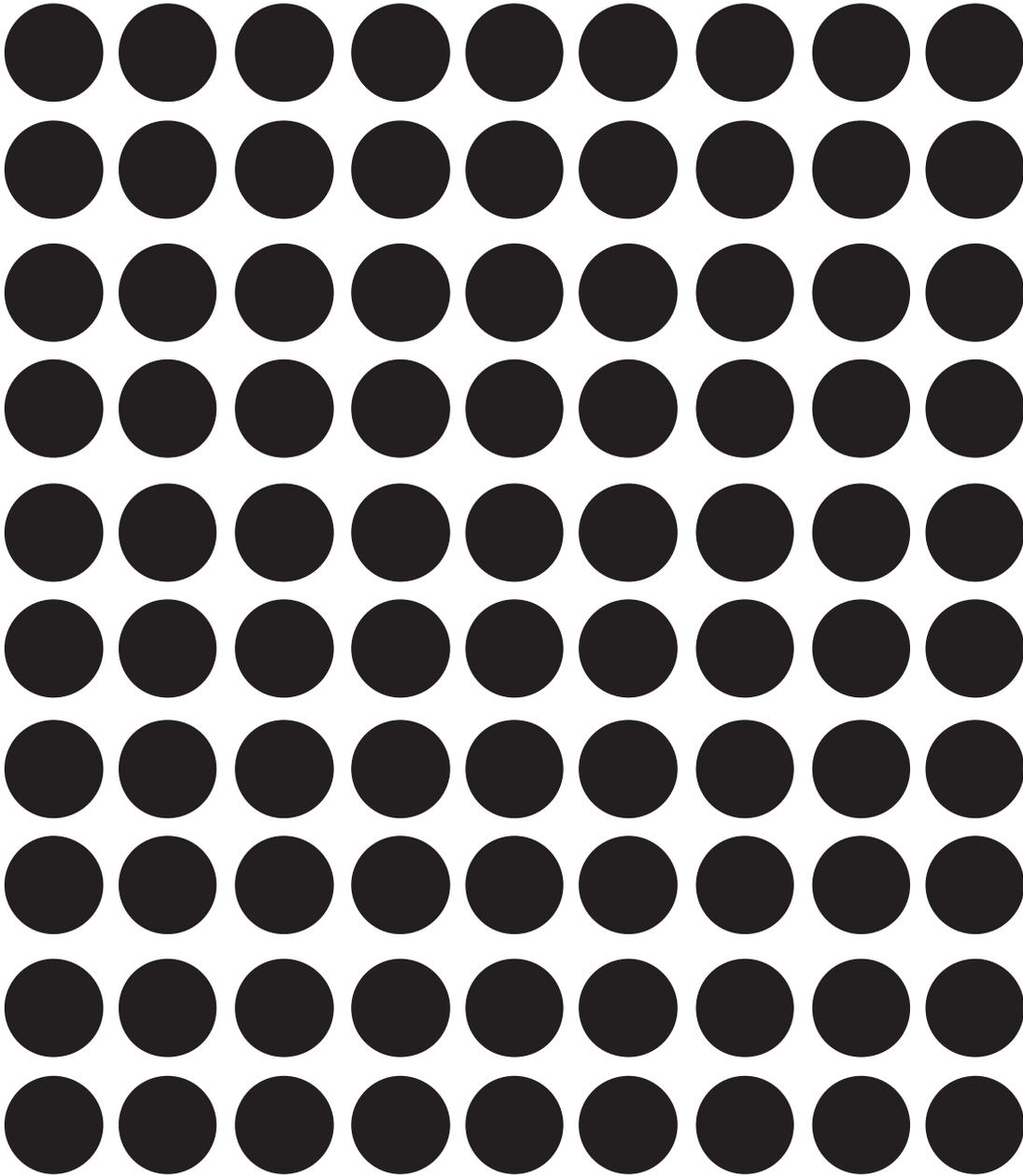


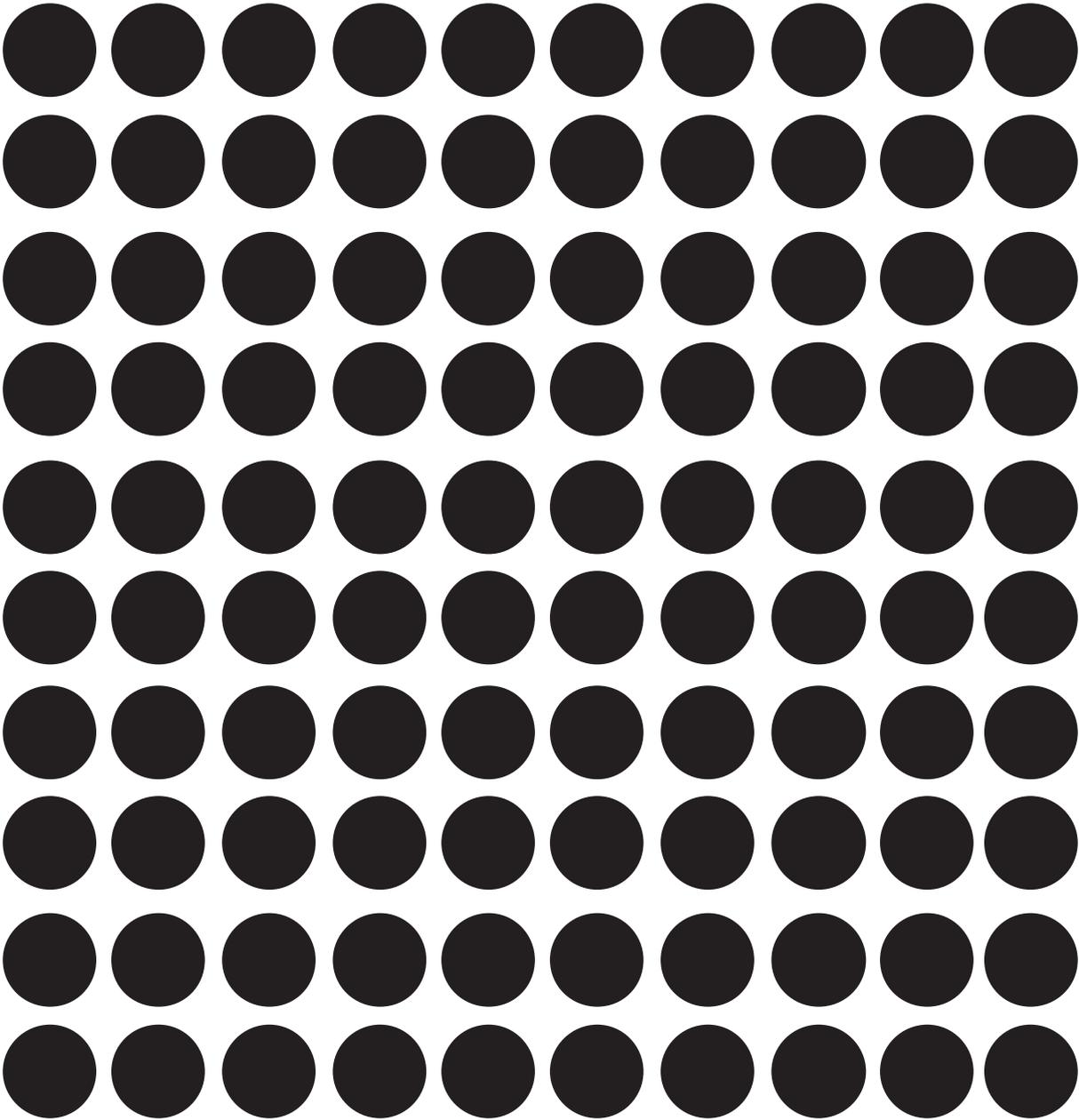












Activity–Fractions Book

Standard

I

Objective

4

Connections

Standard I

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

Objective 4

Use fractions to communicate parts of the whole.

Intended Learning Outcomes

3. Reason mathematically.
4. Communicate mathematically.

Background Information

Through the study of various meanings and models of fractions—how fractions are related to each other and to the unit whole and how they are represented—students can gain facility in comparing fractions often by using benchmarks such as $\frac{1}{2}$ or 1.

Invitation to Learn

Hand out one piece of the Fraction Pie Men to each participant, either a pie or a person. Tell them to keep it hidden until you tell them to “go.” When you say “go” each participant will locate their “fraction match” and stand by that person with their match.

Instructional Procedures

1. Share the story *Apple Fractions*, by Jerry Pallotta. After reading the story, the students will brainstorm all the fractions referred to in the story.
2. The teacher will then say that they are going to turn those ideas into a book of their own. The format for the book is called a “no staples booklet.”
3. The students will fold two pieces of copy paper in half the landscape or horizontally.
4. Then they will measure one inch along the fold, from the outside edge, and put a dot.
5. The students will cut one of the pages between the two dots (on the inside of the paper along the fold marks).
6. The students will then cut, on the second sheet, from the outside edge (along the fold) and stop at the dot. This is one inch from the outside edge, leaving the center of the page uncut. The

Materials

- Set of Fraction Pie Men
- Apple Fractions* by Jerry Pallotta (Scholastic Inc.)
- Student Product Evaluation Sheet
- Two sheets of copy paper per student
- Set of pattern block pieces
- Colored pencils

students will then gently roll the second sheet they cut, and put it halfway through the remaining sheet, with the hole in the middle. The rolled sheet should be allowed to gently unroll. Carefully match all the pages and then fold to make the booklet.

7. Before students begin to add the mathematics content to their fractions booklet, the criteria for evaluation should be outlined on the product evaluation sheet, so that they will know how they will be evaluated. This will increase the quality of their products.
8. Page 1 of the booklet should be the title page. Write: *My Book About Fractions*, created by _____ (students name). (Be sure to write with crayon or colored pencil, marker will bleed through).
9. Page 2 is written on the back of the title page. It is titled, write:
 - a. *Fraction Vocabulary*: A fraction is a ratio of two numbers that stands for part of something.
 - b. *Numerator*: the top number in a fraction tells how many equal parts the fraction represents.
 - c. *Denominator*: the bottom number in a fraction tells how many equal parts are in the whole.
 - d. *Equal Parts Make Fractions*: there must be equal parts of the whole to make a fraction.
 - e. This page should include a diagram and pictures clarifying the meanings of the terms.
10. Page 3 – Students write: *Fractions of a Whole*: A fraction can name part of one thing. Fractions equal to 1. *Halves*: two equal parts are halves. Each part is one half. Halves do not all look the same. Think: 1 out of 2 equal parts. Write: $\frac{1}{2}$ Say: one half. Example: one whole 1 (For each example the students will trace and color their pattern block pieces).
11. Page 4 – Students write: *Thirds*: 3 equal parts are thirds. Each part is one third. Think 1 out of 3 equal parts. Write: $\frac{1}{3}$. Say: one third. (Draw a line across the page, half way to the bottom of the page.)
12. Page 4 – Students write: *Sixths*: 6 equal parts are sixths. Each part is one sixth. Think 1 out of 6 equal parts. Write: $\frac{1}{6}$. Say: one-sixth.
13. Page 5 – *Fraction of a Group*: You can use a fraction to name part of a group. Example: Draw three balls. Color 2 red and 1 blue. Think: 2 out of 3 balls are red. Write $\frac{2}{3}$. Say: two-thirds.

14. Page 6 – *Equivalent fractions*: Different fractions can show the same amount. Examples: One half = three sixths. One third = two sixths. Two-thirds equals = four sixths.
15. Page 7- *Mixed Fractions*: Sometimes you will need to describe a whole and a part. A mixed number has a whole number mixed with a fraction. Fractions greater than 1.
Examples: $1 \frac{1}{2}$, $1 \frac{1}{6}$, $1 \frac{2}{3}$ Write: $1 \frac{2}{3}$. Say: one and two thirds.
16. Page 8 – *Things I've Learned About Fractions*

Pie Man Instructions

Participants

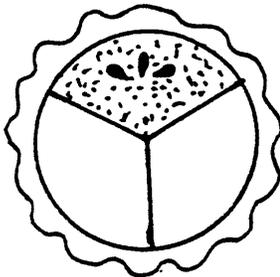
2-4 players

Materials

Bakers



Pies

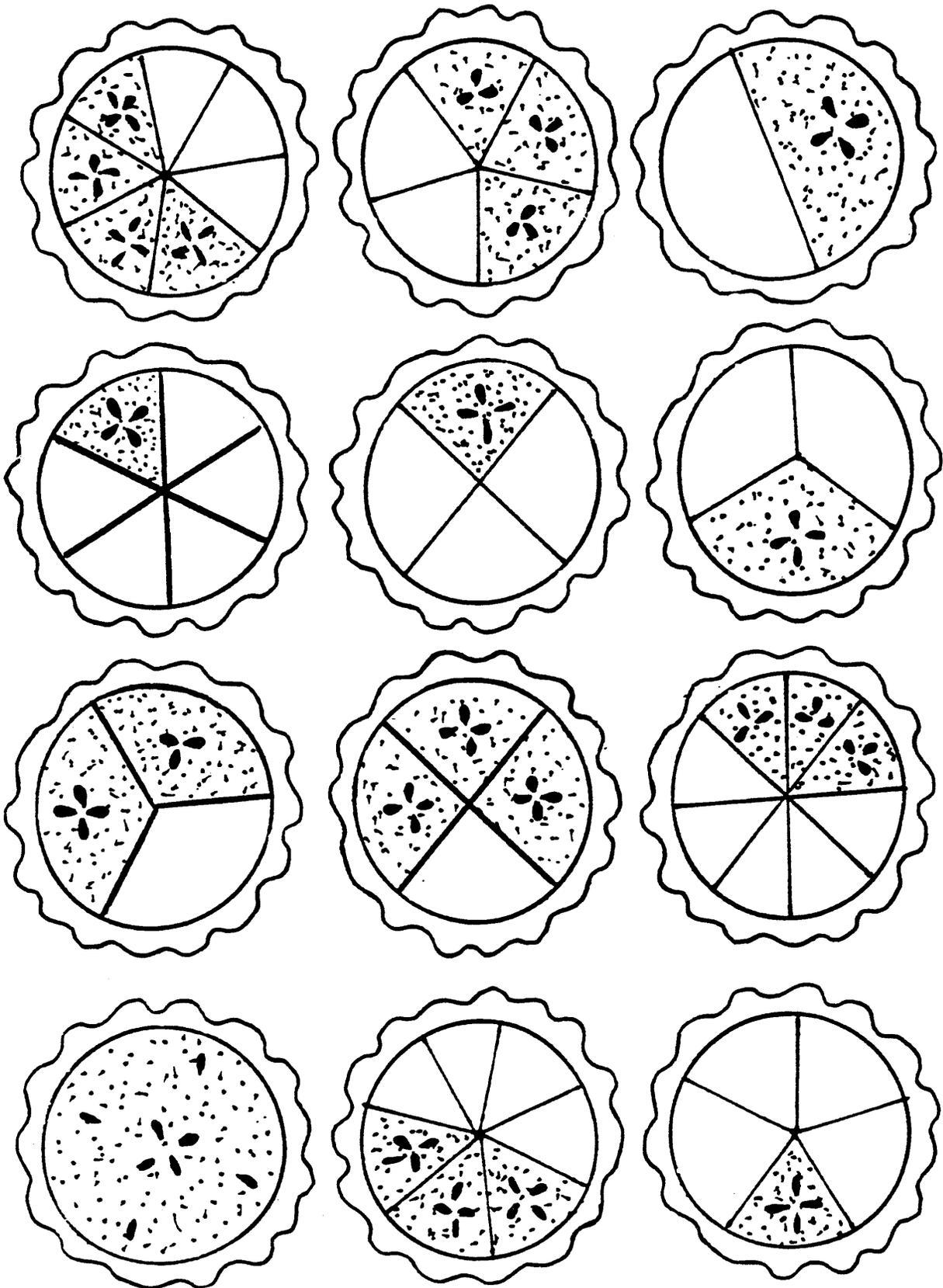


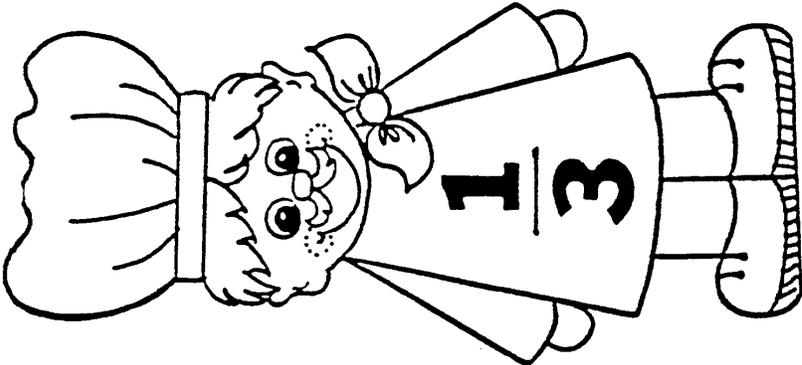
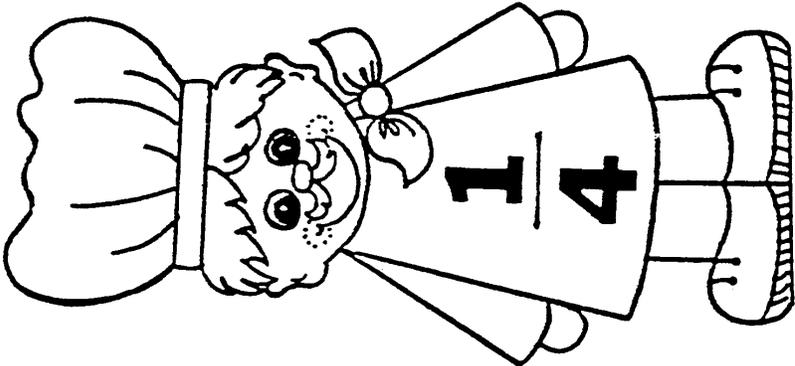
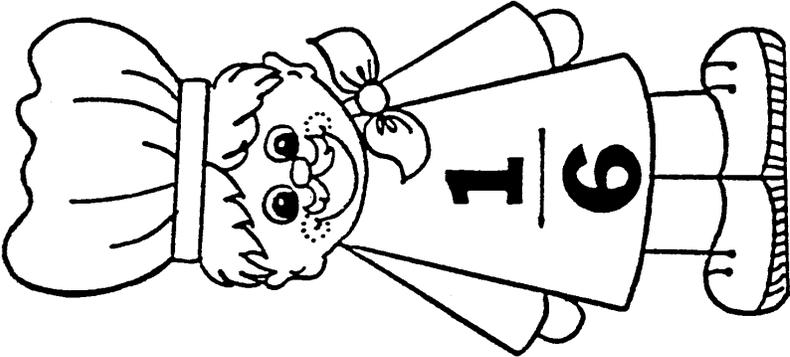
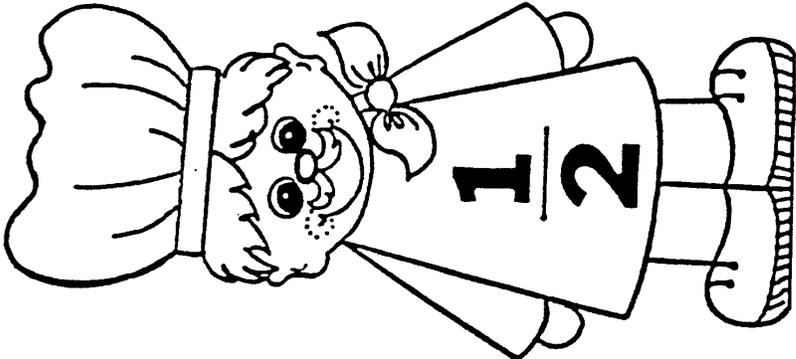
Procedure

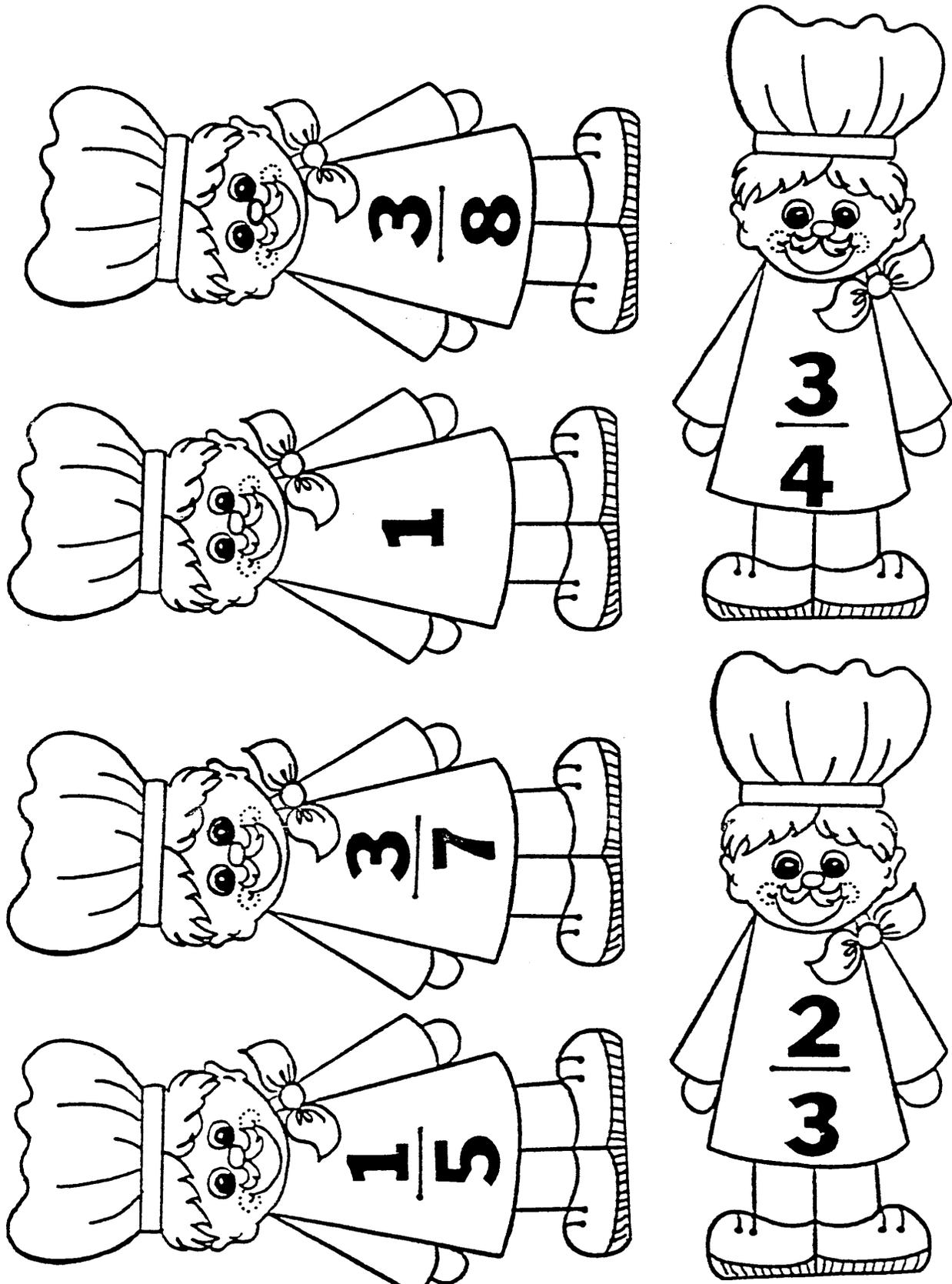
“Pie Man” is played like “Concentration.” Place all the bakers and pies face down on the table. In turn, each player chooses a pie and a baker. If his or her choices match, he or she may keep the pair. If they do not match, he or she turns them back over and they remain in play.

Variation

Place all the pies face up on the table. Place the bakers in a stack face down. Turn over the top baker. All players look to see who can be the first to see the pie it matches. The first player to see it calls out “Pie Man!” and picks up the pie. If correct, he or she may keep the pair.







Activity—Building Fractions Game

Standard I

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

Objective 4

Use fractions to communicate parts of the whole.

Standard

I

Objective

4

Connections

Instructional Procedures

1. Have students work in pairs.
2. A high roll of a numbered cube determines the lead player.
3. The lead player rolls both numbered cubes.
4. The player thinks of the larger number on the cube as the denominator, and the smaller number as the numerator.
5. The player builds that fractional amount on the game mat with pattern block pieces.
6. If a student must use a five as a denominator, it is a lost turn.
7. The winner is the mathematician that has built the greatest number of hexagons on their game mat.

Materials

- Game mat
- Pattern block pieces
- Two dice (digits 1-6)

Possible Extensions/Adaptations

1. Read *Pigs in the Pantry: Fun with Math and Cooking* by Amy Axelrod (Scholastic Inc.)
2. Say, “Each of you is going to create your own fraction sundae. You must have at least ten scoops of ice-cream”.
3. You can choose any flavors you like.
4. You must include at least three different kinds of ice-cream.
5. You must also include a key that is color coded and labeled with the flavors of ice cream.
6. You must also include a clearly labeled fractional representation for each type of ice-cream on the bowl.
7. Label your sundae, “Building an Understanding of Fractions by _____ (student name).”
8. Student will evaluate their work, based on the criteria established prior to making the product.
9. Teacher will evaluate their work, based on the criteria established prior to making the product.

10. Add the teacher and student scores together and divide by two for a final grade.

Additional Assessment or Extension

Fractional Portions of Words

Additional Resources

Website:

Dositey.com URL: http://www.enc.org/redirect/dd/?dd_id+1151

Grades: K – 8

Synopsis: What do a flying saucer, a happy sheep, and the Pyramids of Giza have in common? Well, not much unless you consider that they are all used at this site to make math fun and exciting and –oh yeah—educational for students. Printable worksheets, animated math games and quiz shows, lessons, and mind twisters make Dositey a definite must—do! (For more details see <http://www.enc.org/records/026550/>)

Children’s Literature Supporting Student Understanding of Fractions:

Fannie in the Kitchen by Deborah Hopkinson (S & S) How Fannie Farmer invented recipes with precise measurements. Fannie Farmer is a mother’s helper in the Shaw house, where the daughter gives her the idea of writing down precise instructions for measure and cooking, which eventually became one of the first modern cookbooks.

The Doorbell Rang by Pat Hutchins (Greenwillow Books) Mother has baked a dozen cookies for Victoria and Sam. Just when they have them divided equally, the doorbell rings. The story proceeds with more children coming and the cookies are divided up in a variety of ways.

Fraction Action by Loreen Leedy (Holiday House) Animals look at the different ways that they can divide up food to share with each group. They look at the importance of a fair share.

Gator Pie by Louise Mathews (Sundance Publishing) Alice and Alvin find a pie. They were just about to divide it into half when some more alligators appear. Soon it needs to be divided into 100 pieces. The alligators start a fight over the pie. Alice and Alvin are able to slip away with the pie. They share the pie with each other.

Eating Fractions by Bruce McMillan (Scholastic, Inc.), 1991. This book contains photographs of food items. Children in the book share the food. Children are able to see how the food is divided equally.

Give Me Half! by Stuart J. Murphy (Harper Collins) Two children each have different kinds of food items for lunch. They argue over sharing the food. They finally divide the food and share it.

The Hershey's Fraction Book by Jerry Pallotta (Scholastic, Inc.) The book starts with a whole Hershey's Chocolate Bar. On each page it shows different fractional amounts after breaking the bar into the 12 pieces. It continues by doing computation with the pieces of candy.

Homework & Family Connections

Make a favorite family recipe together. Have the student write the process and procedures they followed in their own words.

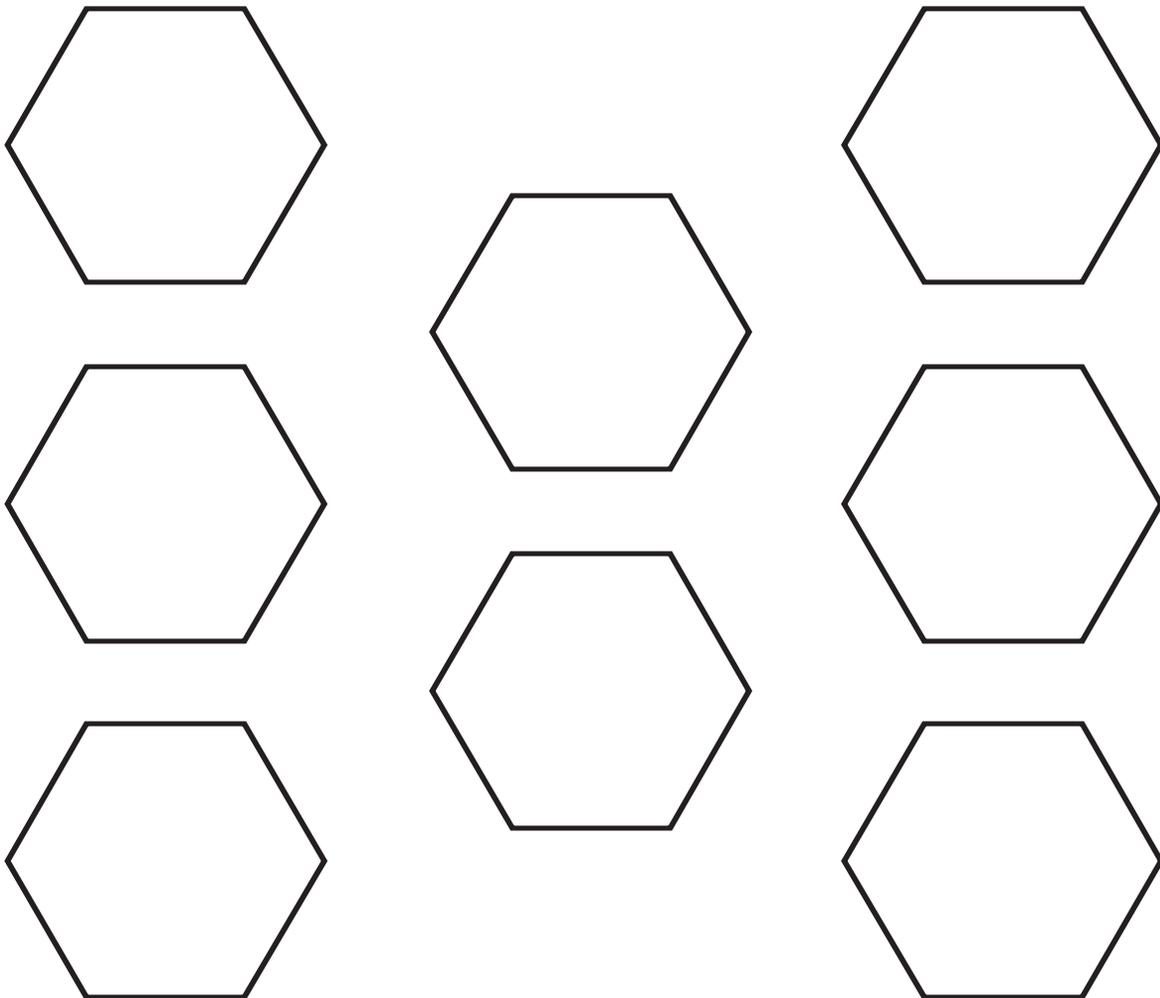
Building Fractions Game Mat

Materials

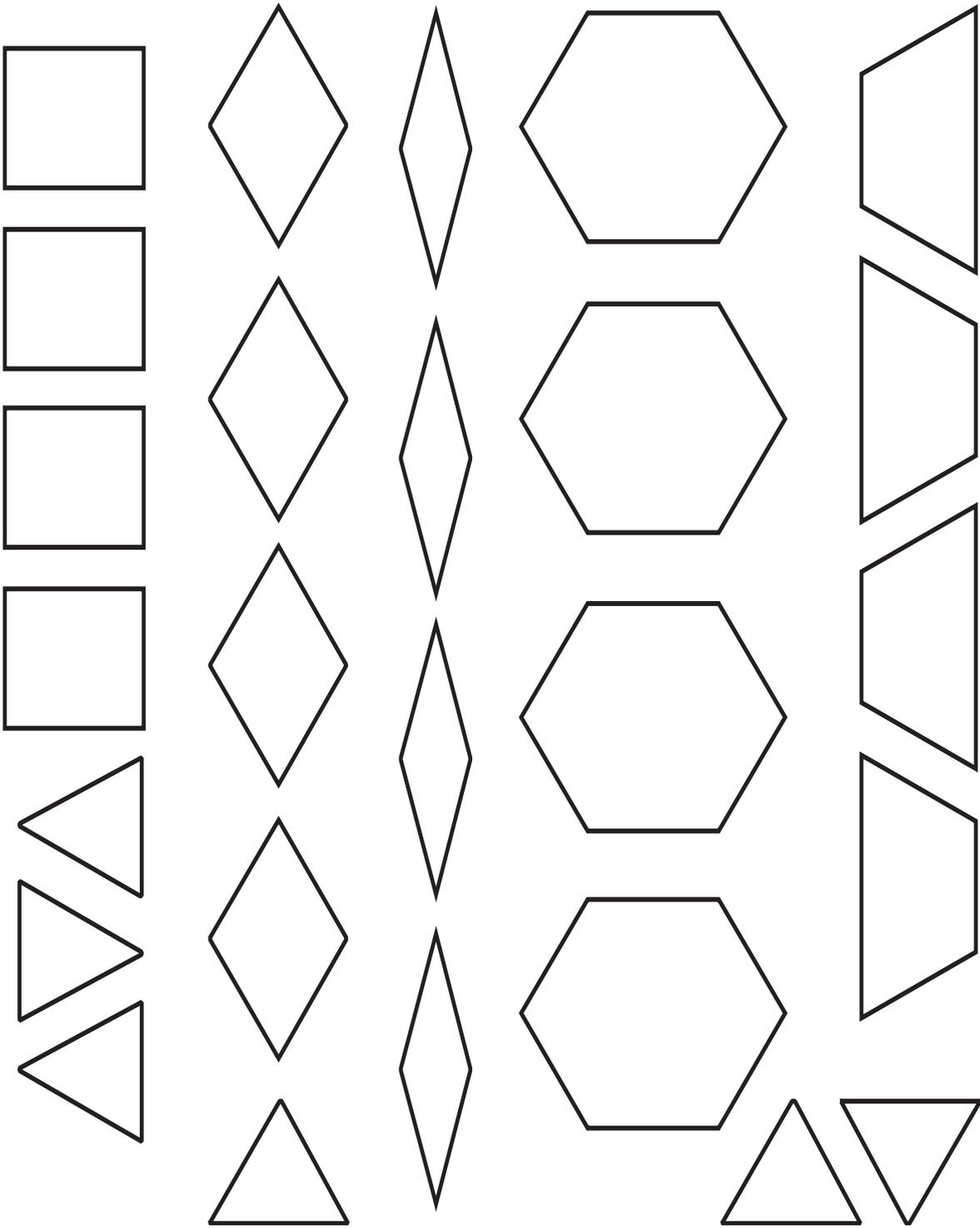
game mat, pattern block pieces, two dice

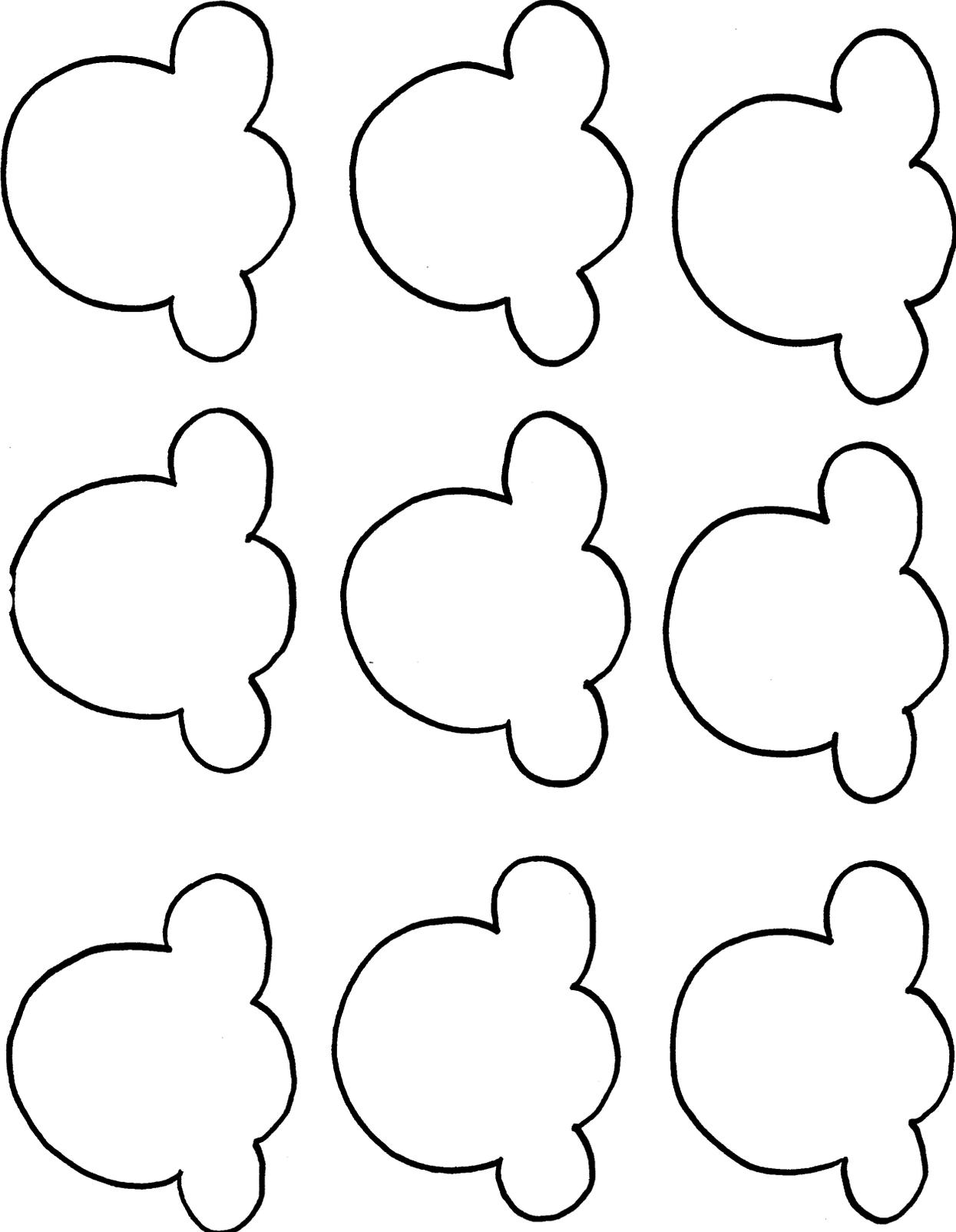
Rules

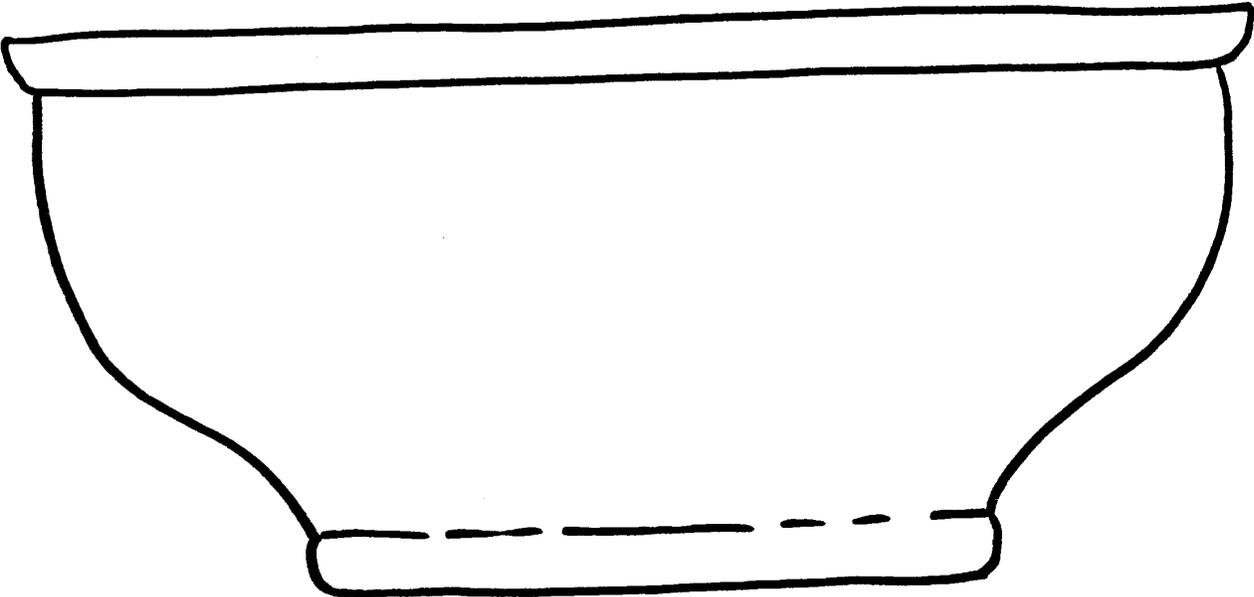
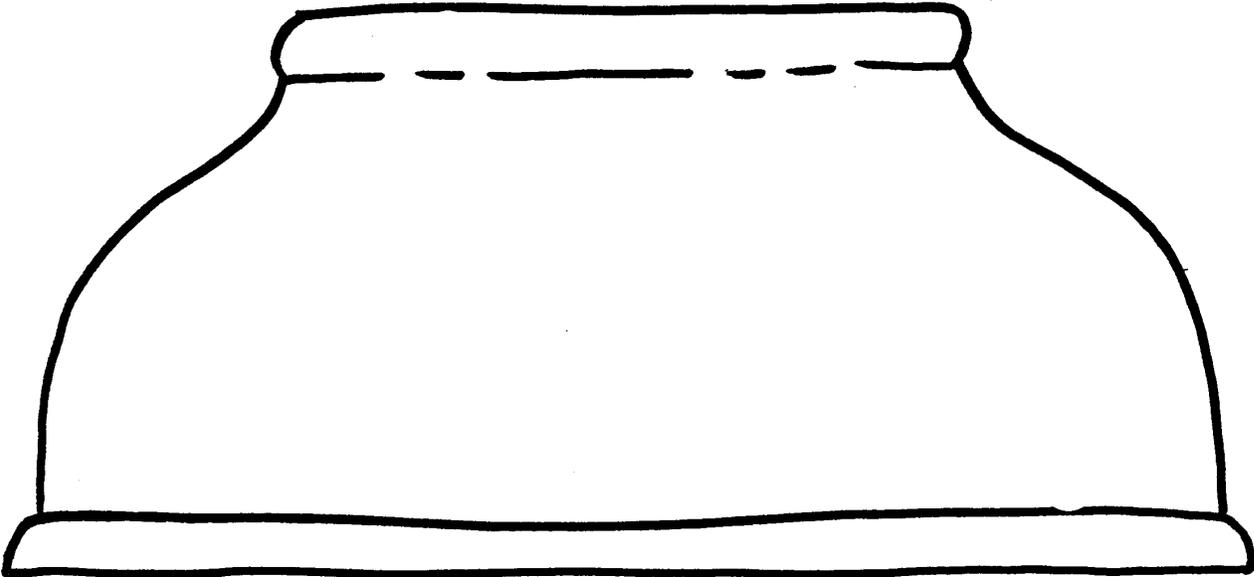
1. Students will work in pairs.
2. Highest roll of a die determines the lead player.
3. The lead player rolls both dice.
4. The player thinks of the larger number on the cube as the denominator, and the smaller number as the numerator.
5. The player builds that fractional amount on the game mat with pattern block pieces.
6. If a student must use a five as a denominator, he loses a turn.
7. The winner is the mathematician that has built the greatest number of hexagons on their mat.



Pattern Blocks







Fractional Portions of Words

1. The first $\frac{1}{2}$ of *food* + the last $\frac{1}{4}$ of *door*.
2. The last $\frac{1}{3}$ of *hat* + the first $\frac{2}{5}$ of *heavy*.
3. The second $\frac{1}{3}$ of *office* + the last $\frac{1}{4}$ of *door* + the first $\frac{1}{3}$ of *street*.
4. The last $\frac{1}{2}$ of *go* + the last $\frac{1}{2}$ of *done*.
5. The last $\frac{1}{8}$ of *elephant* + the first $\frac{1}{5}$ of *order*.
6. The first $\frac{3}{4}$ of *fine* + the last $\frac{3}{4}$ of *dish*.
7. The last $\frac{1}{6}$ of *cement* + the first $\frac{3}{7}$ of *history*.
8. The last $\frac{1}{2}$ of *bath* + the first $\frac{1}{3}$ of *end* + the last $\frac{2}{7}$ of *require*.
9. The first $\frac{2}{5}$ of *water* + the last $\frac{3}{4}$ of *fits*.
10. The last $\frac{1}{6}$ of *Glenda*.
11. The first $\frac{1}{3}$ of *principal* + the first $\frac{1}{2}$ of *zero*.
12. The first $\frac{1}{7}$ of *instant* + the last $\frac{1}{3}$ of *fat*.
13. The first $\frac{2}{5}$ of *young* + the first $\frac{1}{10}$ of *understand*.

***Math
Standard II
Activities***

Activity–Pattern Search

Standard II

Students will use patterns and relations to represent mathematical situations.

Objective 2

Recognize and represent mathematical situations using patterns and symbols.

Intended Learning Outcomes

1. Demonstrate a positive learning attitude towards mathematics.
3. Reason mathematically.
4. Communicate mathematically.
5. Make mathematical connections.
6. Represent mathematical situations.

Standard II

Objective 2

Connections

Background Information

Students have been working with mathematical properties since kindergarten even though they haven't been calling them by the formal names. You will be exploring some of these properties in this activity. Below you will see the name of the properties explored in third grade and a sample of each.

Commutative Property of Addition (sometimes called the Order Property of Addition) $4 + 5 = 5 + 4$

*Commutative Property of Multiplication (sometimes called the Order Property of Multiplication) $4 \times 5 = 5 \times 4$

Associative Property of Addition (sometimes considered grouping) $(6 + 4) + 2 = 6 + (4 + 2)$

*Identity Property of Addition $3 + 0 = 3$

*Identity Property of Multiplication $3 \times 1 = 3$

Zero Property of Multiplication $3 \times 0 = 0$

* *Properties that are introduced in the third grade core.*

Invitation to Learn

Place transparency of p. 7 (ants) from *Grapes of Math* on the overhead or recreate it using plastic ants. Read "Ant Attack" from p. 8 and encourage participants to quickly count the ants before they are removed. Talk about their strategies. Write the numeric expression that helped them count the ants.

Instructional Procedures

Materials

- unifix cubes (shared between 5-6 participants)
- centimeter paper and overhead
- blackline master of array of triangles front/back & overhead
- Grapes of Math* by Greg Tang
- transparency copy of p. 7 of *Grapes of Math* or plastic ants

1. *For the Summer Core Academy Participants:* Review the commutative property and the identity and zero properties of multiplication with unifix cubes, illustrate with centimeter paper and record the algorithm. Briefly review the associative property of addition.

For students: You may want to select a few properties to review such as the Commutative and Associative. You may wish to review just the properties that have been learned during the multiplication unit. Make the lesson fit your needs at this time.

2. Distribute copies of the blackline master showing an array of triangles to the students. Ask how many triangles are in the array. Point out that there are many interesting ways to find the answer. The object of the rest of this activity will be not to count the individual 32 triangles, but to look for various patterns in the array and to translate the visual patterns into numeric equations. “In what ways will the Commutative, Associative, Identity, or Zero Properties help you when looking for patterns?”
3. Place a transparency copy of the blackline master on the overhead and discuss possible numeric expressions. (The participants might start with an with a simple one such as $1 + 3 + 5 + 7 + 7 + 5 + 3 + 1$.)
Did anyone look for “doubles”? Did anyone “make tens”?
4. Can you find a 5 X 4 rectangle inside this array of triangles? How would you write the remaining numeric expression? [$(5 \times 4) + 4 + 4 + 2 + 2$ or $(5 \times 4) + (2 \times 4) + (2 \times 2)$]
Can demonstrate commutative property $20 + 4 + 4 + 2 + 2 = 2 + 2 + 4 + 4 + 20$.
Can demonstrate associative property $(20 + 4 + 4) + 2 + 2 = 20 + (4 + 4 + 2 + 2)$.
5. Explore and record as many patterns as possible with your partner.
Record the numeric expression below the picture after it is partitioned.
Think of another way to write the numeric expression and record it.
Be able to defend your reasoning as to why the different numeric expressions have the same sum. Find ways of shortening numeric expressions.

F. Y. I. As I tried this activity with several classes, I found that the students wanted their own activity sheet. The resource students struggle with writing the numerical equation and may need extra help.

Curriculum Integration

Math/Science—Create your own simple array and exchange with a partner. How many different ways can the simple array be partitioned? Can you record the different numerical equations?

Possible Extensions/Adaptations/Integration

Finish reading *The Grapes of Math* to the class. As a class, create a rhyming math puzzle and picture similar to the book. Talk about how it is created and how to find rhyming words. How would you give the clue in the last stanza? Ask students to work in groups to create a “group” rhyming math puzzle similar to the samples in *The Grapes of Math*. The group must also create a picture to support the puzzle. Combine the group puzzles to create a class book of “Mind-Stretching Math Riddles”.

Assessment Suggestion

See rubric sample.

Additional Resources

Math For all Seasons by Greg Tang

Navigating Through Algebra in Grades 3-5 (I Spy) Navigation Series
NCTM

Homework & Family Connections

Take a new blackline copy and the completed “Pattern Search” copy. Have the student teach their parent three patterns and the correlating numeric equations. Together, they can discover another way to write the numeric equations or find another undiscovered pattern. The parent should write a comment to their child on the homework.

220 Arizona Mathematics Rubric

Source: Arizona Department of Education

Subjects:	Mathematics	# of scales	3
Grades	3-12	Sales length	5

Holistic Scale

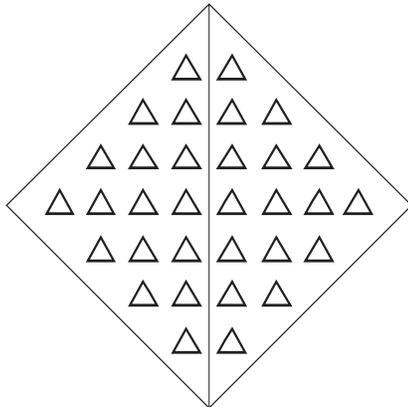
- 4** Response represents an effective solution. It shows complete understanding of the problem, thoroughly addresses all points relevant to the solution, shows logical reasoning and valid conclusions, communicates effectively and clearly through writing and/or diagrams, and includes adequate and correct computations and/or setup. It may contain insignificant errors that do not interfere with the completeness or reasonableness of the student's response.
- 3** Response contains minor flaws. Although it shows an understanding of the problem, communicates adequately through writing and/or diagrams, and generally reaches reasonable conclusions, it shows minor flaws in reasoning and/or computation or neglects to address some aspect of the problem.
- 2** Response shows gaps in understanding and/or executions. It shows one or some combination of the following flaws: an incomplete understanding of the problem, failure to address some aspects of the problem, faulty reasoning, weak conclusions, unclear communication in writing and/or diagrams, or a poor understanding of relevant mathematical procedures or concepts.
- 1** Response shows some effort beyond restating the problem or copying given data. It shows some combination of the following flaws: little understanding of the problem, failure to address most aspects of the problem, major flaws in reasoning that lead to invalid conclusions, or lack of understanding of relevant mathematical procedures or concepts.
- 0** Response shows no mathematical understanding of the problem or the student has failed to respond to the item.

A wonderful website that has a nice assortment of different kinds of rubrics is:

http://intranet.cps.k12.il.us/Assessments/Ideas_and_Rubrics/Rubric_Bank/rubric_bank.html

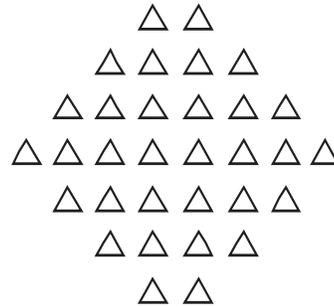
Pattern Search

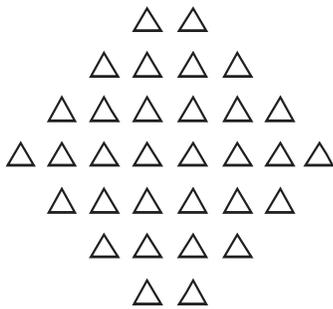
Find as many different ways as you can to partition the array of triangles below. Record each way as a numerical equation.

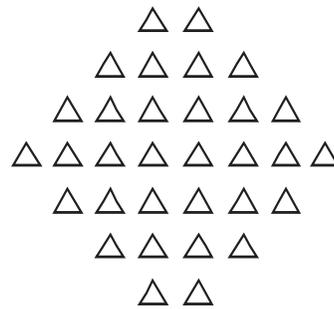


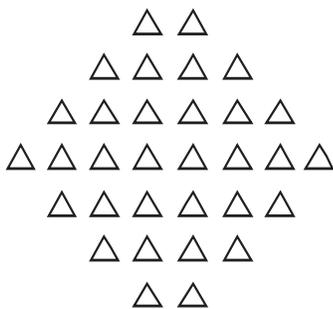
$$\underline{16+16=32}$$

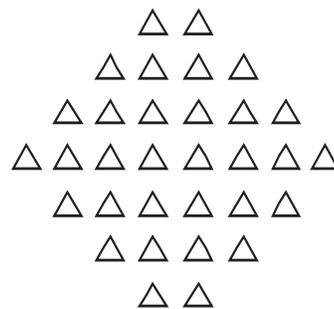
$$\underline{2 \times 16 = 32}$$

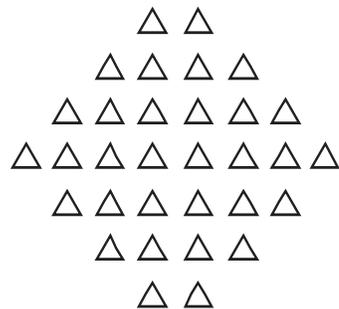
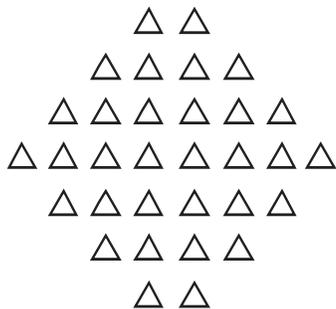
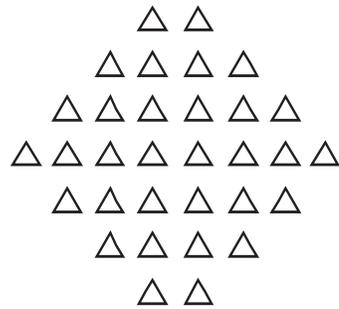
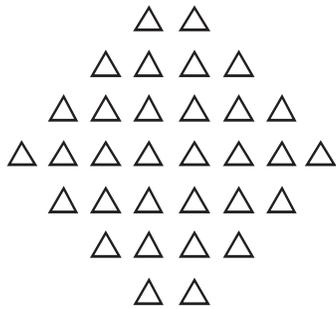
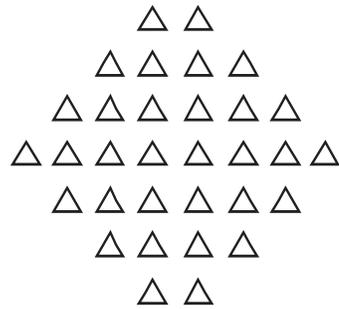
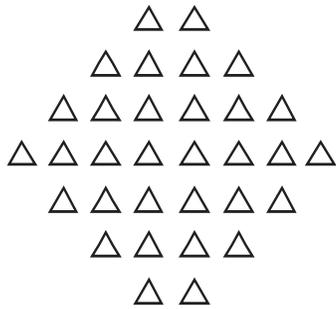












Activity—Growing Critters

Standard II

Students will use patterns and relations to represent mathematical situations.

Objective 1

Recognize and create patterns with given attributes.

Intended Learning Outcomes

1. Demonstrate a positive learning attitude towards mathematics
2. Become mathematical problem solvers
3. Reason mathematically
4. Communicate mathematically
5. Represent mathematical situations

Standard II

Objective 1

Connections

Background Information

This lesson will be dealing with creating and extending growing patterns using pattern blocks. Growing patterns are patterns in which the basic core pattern grows or changes in a predictable way.

An example of a growing pattern could be:

		X
	X	X
X	X	X
X	X	X
XXX	XXXX	XXXX

Invitation to Learn

Form a circle of 5-6 people. Begin activity by having the first person snapping their fingers. The second person takes their turn by snapping their fingers and then adding an action like tapping their left foot. The third person repeats the first and second actions and adds a third. This pattern continues until the last person adds their own action. Now have the whole group do the entire sequence together. After this “trial run,” can you go through the entire sequence at a faster pace? Can you do it backwards? Finish this activity by explaining that the core of the pattern grew with each new added action.

Instructional Procedures

Materials

- pattern blocks
- blackline and overhead (attachment 1)

Students will work with partners

Distribute materials:

- Pattern blocks (3-4 sets per table grouping – many blue rhombi are needed for this activity)
 - Copy of “Demonstration Critter” (2 per table group)
 - Have the students create the Pattern Block Critters they see on the blackline master.
1. An invented Pattern Block Critter has been started for you. The number of blocks used at each stage will increase in a predictable way. This is the first two stages or terms of the Critter. Compare the two. How are they alike? How are they different? (Ex. You might say the original critter has a head before the core or term begins.) Show each stage numerically on a table (use overhead).
 2. Predict, discuss, and build the third stage with your partner. Share the solutions and have the participants discuss their reasoning.

The square on the critter remained constant. The hexagon on the critter increased once, and remained the same number as the term. The blue rhombus started with four in the first term and increased four in the second term, but increased six the third term, etc.

How did you find the total number of blocks? What was the easiest way?

3. Can you predict the total number of blocks it would take to build the Critter in the seventh stage? Use your table to help with this prediction. Describe the pattern in words.
4. CHALLENGE

Can you create a growing Pattern Block Critter and predict what it will look like when it has reached the fifth stage?

- a. You will work with a partner to create your own critter. Your critter will need to have a pattern that shows growth in a predictable way.
- b. Trace the first three stages of your critter and record the number of blocks used for each stage.
- c. On a separate piece of paper, predict and discuss with your partner to decide what your critter will look like in the fifth stage. You may use your blocks, a table or chart, or some other method to help you find or verify your answer.

- d. Leave your first stage and second stage critter on top of your desk. Have a “classroom walk” and see if your classmates can figure-out the fifth sequence of your critter.

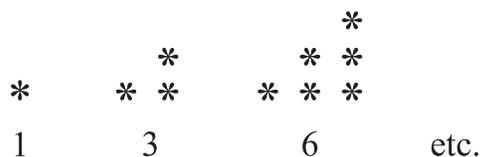
Curriculum Integration

Math/Science—Take a schoolyard fieldtrip “saunter” with the math/science journal in hand and find any “growing” patterns in nature (examples could include hopscotch pad, fencing, etc.). Debrief once the class gets back in the classroom.

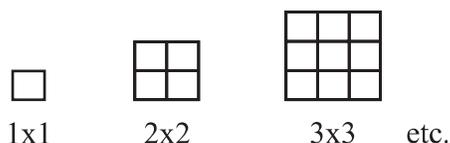
Possible Extensions/Adaptations

Science Standard II: Living & Nonliving Things in a Small Environment. Pill bugs have one pair of legs per section on their body, millipedes have two legs per segment, etc. You could require a critter that has the same attributes as the creatures that are being studied in your living and nonliving unit.

The triangular number pattern is a sample of growing patterns. See the pattern below.



The square number pattern is a sample of growing patterns. See the pattern below.



Assessment Suggestion

Journal entry suggestions: What strategies did you and your partner decide to use to verify the fifth day stage of your critter?

Can you think of a way to figure out what your critter would look like on any given stage and how many blocks you would need to build it? If so, describe your strategy.

Was it easy to create a critter that would grow in a predictable way? Explain your answer.

Additional Resources

Algebra in My World TEAMS

Navigating Through Algebra Grades 3-5

Illuminations <http://illuminations.nctm.org/index2.html>

http://www.marco.polo-education.org/partner/32ill_patterns.cfm

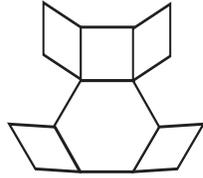
The Super Source Pattern Blocks (ETA/Cuisenaire Grades)

Die-Cuts for pattern blocks

Homework & Family Connections

Send some grid paper home with the student. Establish that one square unit has the area of one. The students should draw around the 1 X 1 square and record the area. They should do the same for 2 X 2, 3 X 3 and so on up to the seventh such square. Predict the area of the eighth, ninth, and tenth square based on the pattern developed from the previous squares.

Demonstration Critters

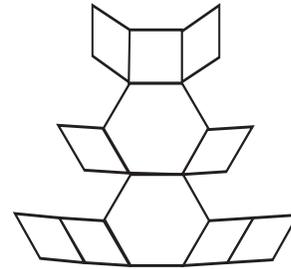


Square 	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____

Hexagon 	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____



Blue Rhombus 	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____

Total	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____

Activity–Multiples of Patterns

Standard II

Objectives 1 & 2

Connections

Standard II

Students will use patterns and relations to represent mathematical situations.

Objective 1

Recognize and create patterns with given attributes.

Objective 2

Recognize and represent mathematical situations using patterns and symbols.

Intended Learning Outcomes

1. Demonstrate a positive learning attitude towards mathematics.
3. Reason mathematically.
4. Communicate mathematically.
5. Make mathematical connections.
6. Represent mathematical situations.

Background Information

Third grade students should become familiar with basic multiplication combinations and should have many experiences in finding and describing patterns.

Invitation to Learn

Have the class sit in a circle on the floor. Give every student five Tootsie Rolls to lay on the floor in front of them. This week, the class will practice the multiples of three by skip counting up to 27. (Twenty-seven was selected because it is the ninth multiple of three. When other multiples are practiced, state the ending number before the students begin to count.) Everyone will pat their knees, clap their hands, and snap their fingers. The person to start the skip-count by three's will begin on the snap of their fingers with "0." The person sitting next to them will say "3" on the next snap of the fingers, and so on. Should a student state the wrong number instead of the multiple, then they will have to put a Tootsie Roll into the center of the circle. The cycle begins where it left off with the next child. The student that reaches "27" gets to take all the Tootsie Rolls from the middle of the circle. The play begins again. (Submitted by Jodi Rees taken from a workshop by Kim Christopherson & Kris Thurgood.)

Instructional Procedures

1. Distribute the multiplication table without the index. Find the line of symmetry. This means that the square that has a 12 in it will lay on top of another square that has a 12 in it. Fold your paper on this line of symmetry.

What kinds of patterns do you notice? (A few more than half of the facts need to be memorized due to the Commutative Property.) Where are the square numbers? (Notice the numbers along the fold that are even/odd. etc.)

2. Each student will need the smaller multiplication chart without the index. Do this activity at the time when the class is studying the model, patterns, and strategies of a particular set of multiplication facts. For the workshop sample, we will do a variety of facts for discussion purposes.
3. Each group will be assigned to color the multiples of designated facts.
4. In the students' journal, they will need to take a silent moment and write down any pattern they observe on their multiplication chart. At a designated time, the students will turn to a partner and share, adding their neighbor's observations to their own journals. A class chart will be created.

At the end of the week, each student will glue their multiplication pattern on a chart to create a "Multiplication Quilt" (this idea was shared by Linda Flynn). Once several patterns have been glued on the quilt, the patterns can be compared and discussed. Sample questions have been included.

- Are there any tables that have the same or similar patterns?
- Is there a difference between the tables with multiples of even numbers and the tables that show multiples of odd numbers? Explain your thinking.
- Should "0" around the outside edge be colored? Explain your thinking.
- Looking at table 8, why is every other number shaded in the row four? Which number/numbers are shaded in row seven? Why? Which row/rows are completely shaded? Why?
- (For the adult participants) Which of the multiplication patterns look alike and why? (2, 3, 5, 7, & 11 are prime) If we continued, how would 13 & 17 appear? What would "1" look like and why?

Materials

- Bag of Tootsie Rolls
- Multiplication chart
- Crayons, markers, or colored pencils
- Calculator (for the "multiple race")

Curriculum Integration

Math/Science—Use the calculator constant key to practice the multiples of a given number. Look at the patterns that are created. This can be done with partners or alone.

Possible Extensions/Adaptations

Houghton Mifflin 2001 Text Grade 3rd : Level 3.1 Celebrating Traditions Theme 2: Rewards

The Keeping Quilt by Patricia Polocco

Assessment Suggestion

List five patterns in your math journal that you see on your multiplication chart.

Additional Resources

The Best of Times by Greg Tang

Sea Squares by Joy Hulme

Spunky Monkeys on Parade by Stuart J. Murphy

Bats on Parade by Kathi Appelt

One Hundred Hungry Ants by Elinor J. Pinczes

Homework & Family Connections

Send a multiplication chart home with the students. The student must convince their parents why only one half of the chart has to be memorized. The parent will need to write back to tell if the argument was convincing.

Multiplication Chart

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Activity—Tube Roll

Math Standard II

Students will use patterns and relations to represent mathematical situations.

Objective 1

Recognize and create patterns with given attributes.

Intended Learning Outcomes

1. Demonstrate a positive learning attitude towards mathematics.
2. Become mathematical problem solvers.
3. Reason mathematically
4. Communicate mathematically
5. Make mathematical connections
6. Represent mathematical situations

Standard II

Objective 1

Connections

Background Information

The purpose of this activity is to have the students collect data as they conduct a simple experiment with measurement, slope, and gravity. A sphere will roll through a paper tube that is in various positions. Usually, the steeper the slope, the farther and faster the sphere will roll. Eventually, the height of the slope will become so steep that the sphere will no longer continue to roll as far as it had previously. This is because the forward motion of the sphere is absorbed into the floor.

Invitation to Learn

Which is easier to follow behind on a one-lane road, a semi truck going uphill or a semi truck going downhill? Why?

Instructional Procedures

Form teams with 4-5 members each.

1. Roll the sheet of index paper to form a tube that is 11" long and secure the loose edge with tape. Make sure the tube is large enough that the marble (ball bearing, clay ball, or small toy car) can roll through it without getting stuck inside.
2. Have one team member hold the centimeter ruler perpendicular to the floor. Another team member will hold the tube so that the opening of the top of the tube will touch the ruler at the needed measured height required on the chart. Hold the tube loosely so that it is not smashed down onto the floor, but is gently touching the floor. During this experiment, you will change the slope of the tube and measure the distance that the marble rolls after leaving the tube. Be sure to measure from the opening of the

Materials

- tape
- 1 sheet of Index paper or Cardstock (8 1/2" X 11")
- marble (or other spheres such as a ball bearing or clay ball), or small toy car
- centimeter Ruler
- meter tapes
- recording sheet and overhead

bottom of the tube to the place where the marble rests. (The teacher will want to demonstrate the placement of the ruler and the tube.)

3. Predict the height that will make the marble roll the longest distance before actually dropping the marble down the tube.
4. When the team has decided which height they would like to try first, the third team member will place the marble in the top of the tube and let it roll.
5. The fourth team member will measure the distance the marble rolled from the opening of the tube on the floor with the meter tape and record it on the chart. Each team may roll twice for each height and “officially” record the farthest distance on the chart.
6. Answer the questions as a team.

Curriculum Integration

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

Objective 1: Make predictions based on a data display.

Assessment Suggestion

Observation, debrief, communication

The questions on the record sheet could be used as an assessment.

Homework & Family Connections

Try this same type of experiment at home, but find something at home that gravity will pull through the tube. Create a chart similar to the one used in class. Experiment with the tube. What happens if the tube is wider, longer, shorter? (Provide the each student with 2 pieces of index paper for homework.)

Recording Sheet

Height of Tube	Distance the Object Rolled
0 cm	
5 cm	
10 cm	
___ cm	
___ cm	
___ cm	
___ cm	

1. Which height do you predict will cause the marble to roll the longest distance?

2. Was your prediction correct? _____ What is your reasoning?

3. Would a larger marble roll farther? _____ Trade your original marble for the larger marble and try a few rolls to test your prediction.

4. What happened to the marble when you placed the tube on the ruler mark “0” or “25”? Why do you suppose?

5. Does the surface of the floor make a difference? (e.g. cement, carpet, tile, dirt, etc.)

6. Does the surface of the ball make a difference? (clay compared to metal)

7. Think of a question that can be answered with this experiment.

Metric Tape Measure I

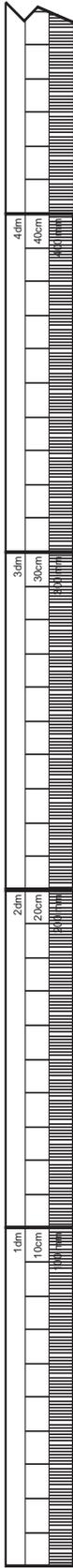
Cut each rectangle down the center of the bold lines. Tape rectangles together to create a meter tape. Label the meter tape as shown in the example.



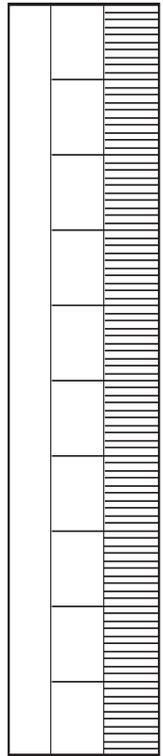
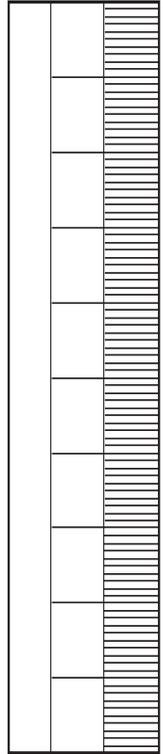
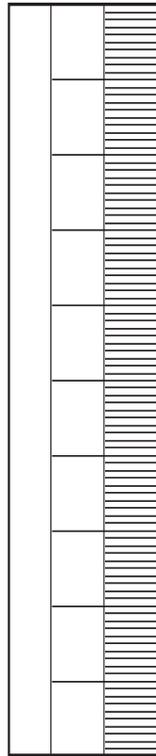
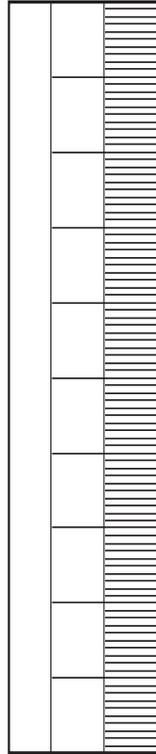
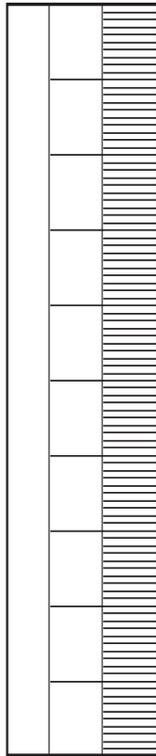
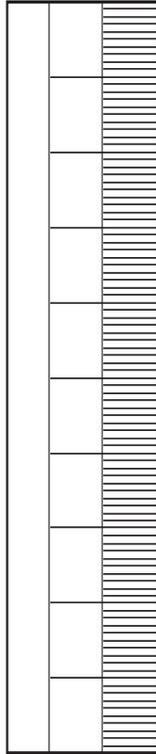
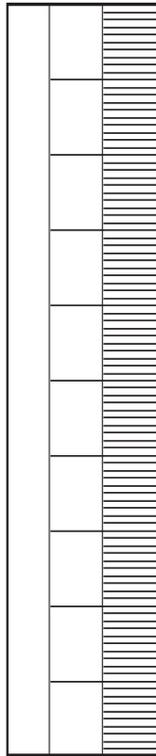
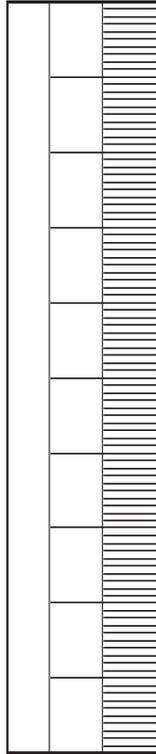
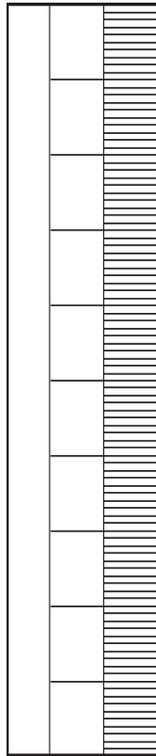
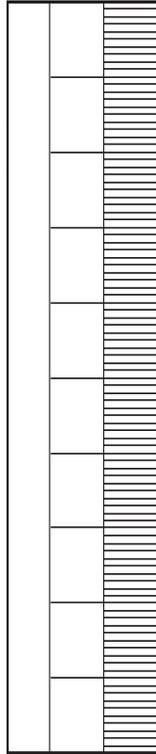
Adapted from Gayle Cloke

Metric Tape Measure 2

Cut each rectangle down the center of the bold lines. Tape rectangles together to create a meter tape. Label the meter tape as shown in the example.



Adapted from Gayle Cloke



***Math
Standard III
Activities***

Activity—Shapes Are Everywhere

Standard III

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

Objective 1

Describe, identify, and create geometric shapes.

Intended Learning Outcomes

1. Demonstrate a positive learning attitude towards mathematics.
2. Become mathematical problem solvers.
3. Reason mathematically.

Standard III

Objective 1

Connections

Background Information

Definitions

square: A polygon that has four equal sides and four right angles.

rectangle: A polygon that has four sides and four right angles.

triangle: A polygon that has 3 sides.

polygon: A closed plane figure made by line segments.

rhombus: A parallelogram with all four sides equal in length.

trapezoid: A quadrilateral with one pair of parallel sides and one pair of sides that are not parallel.

quadrilateral: A polygon that has 4 sides.

hexagon: A polygon that has 6 sides.

octagon: A polygon that has eight sides.

sides: A line segment forming part of a plane figure.

corner: An intersection of two sides.

face: A plane figure that serves as one side of a solid figure.

symmetry: A line that divides a figure into two congruent halves that are mirror images of each other.

angles: Two rays with a common endpoint.

right: A triangle that measures exactly 90° .

obtuse: An angle with a measure of greater than 90° and less than 180° .

acute: An angle with a measure less than 90° .

mirra or mirrors: A semi transparent plastic device that allows students to draw reflected images to examine symmetry.

Invitation To Learn

Students explore pattern blocks noticing their similarities and differences, then share with other team members.

Instructional Procedures

Materials

For teacher:

- Shapes, Shapes, Shapes* by Tana Hoban

For each student:

- 3 rectangles
- 3 squares
- 3 triangles
- 3 circles
- 3 hexagons
- alphabet paper
- math journals
- construction shapes for “Who Say’s I’m Square?”

For each team:

- pattern blocks
- mirra or mirrors

1. Brainstorm with students to see what prior knowledge they have on identifying a polygon.
2. Use an overhead to show illustrations of polygons and nonpolygons.
3. Read *Shapes, Shapes, Shapes* by Tana Hoban while pointing out the many, varied shapes in the first few pictures. Have students help identify shapes in following pages.
4. Explain all the pattern blocks that they explored are polygons.
5. Ask students to name other possible polygon shapes as you draw them on the overhead.
6. Ask students to copy the definitions of corners and sides in their journals.
7. Have students draw 3 polygons in their journals and identify their corners and sides.
8. Choose a few students to draw one of the polygons on the board to further show their understanding.
9. Using construction pieces, students can make a geo shape man (“Who Says I’m Square?”).

Part 2: Who Says I’m Square?

Following the instructions on the skill sheet, students will create a geo shape person with movable body parts.

Part 3: The House That Jack Built

1. Retell the story from *The House that Jack Built*.
2. While telling the story, model making the characters in the story by using overhead tangram shapes.
3. Have the students follow your example making the characters by using their own tangram pieces.

Part 4: Equal is Equal

1. Define symmetry as students write the definition in their journals. Demonstrate by folding a large paper circle showing the lines of symmetry.
2. Demonstrate 1 line of symmetry using a large paper square and instruct students to explore other lines of symmetry using paper squares.
3. Provide students with triangles and rectangles to explore possible lines of symmetry.
4. After a discussion, students should draw lines of symmetry on paper triangles, circles, squares, and rectangles.
5. Introduce a mirror and demonstrate its use for symmetry.
6. Have students glue a square, rectangle, circle, and triangle in their journal showing lines of symmetry.
7. Demonstrate what a mirror is and how to use it for symmetry using pattern blocks.

Activity 5: Are You A-Cute Angle?

1. Demonstrate acute, obtuse, and right angles for the class by using your arms.
2. Refer to the idea that the acute angle is smaller and is therefore “cute.”
3. Play “Simon Says” with students, showing the three angles as they are called.
4. Have students draw and write definitions of each angle in their journals.

Curriculum Integration

Math/Science—How many lines of symmetry does the moon have when it is full?

Possible Extensions/Adaptations/Integration

Reading: Cubes for literature, each face representing characters, plot, problem, solutions, beginning, middle, end, vocabulary words, etc. that relate to a story.

Art: William Harnet’s painting of “My Gems” pointing out geometric shapes.

Art: Make an art project with a symmetry design using complementary colors.

Art: Have students make a still life drawing using the geometric shapes.

Art: Have students transfer their learning outcomes by making an art project using symmetry.

Assessment Suggestions

Provide a copy of an alphabet for students. Check students understanding of symmetry as they draw the lines of symmetry on the letters of the alphabet.

Show an overhead of angles and instruct students to write down 1 to 10 on their paper and identify the different angles in writing.

Have students identify the corners and sides of various shapes.

Additional Resources

The Silly Story of Goldie Locks and the Three Squares by Grace Maccarone

Let's Fly A Kite by Stuart J. Murphy

Three Pigs, One Wolf, and Seven Magic Shapes by Grace Maccarone

Grandfather Tang's Story by Ann Tompert

Navigation through Geometry in Grades 3-5 by Katherine Gavin, Louise P. Belkin, Ann Marie Spinelli, and July St. Maire

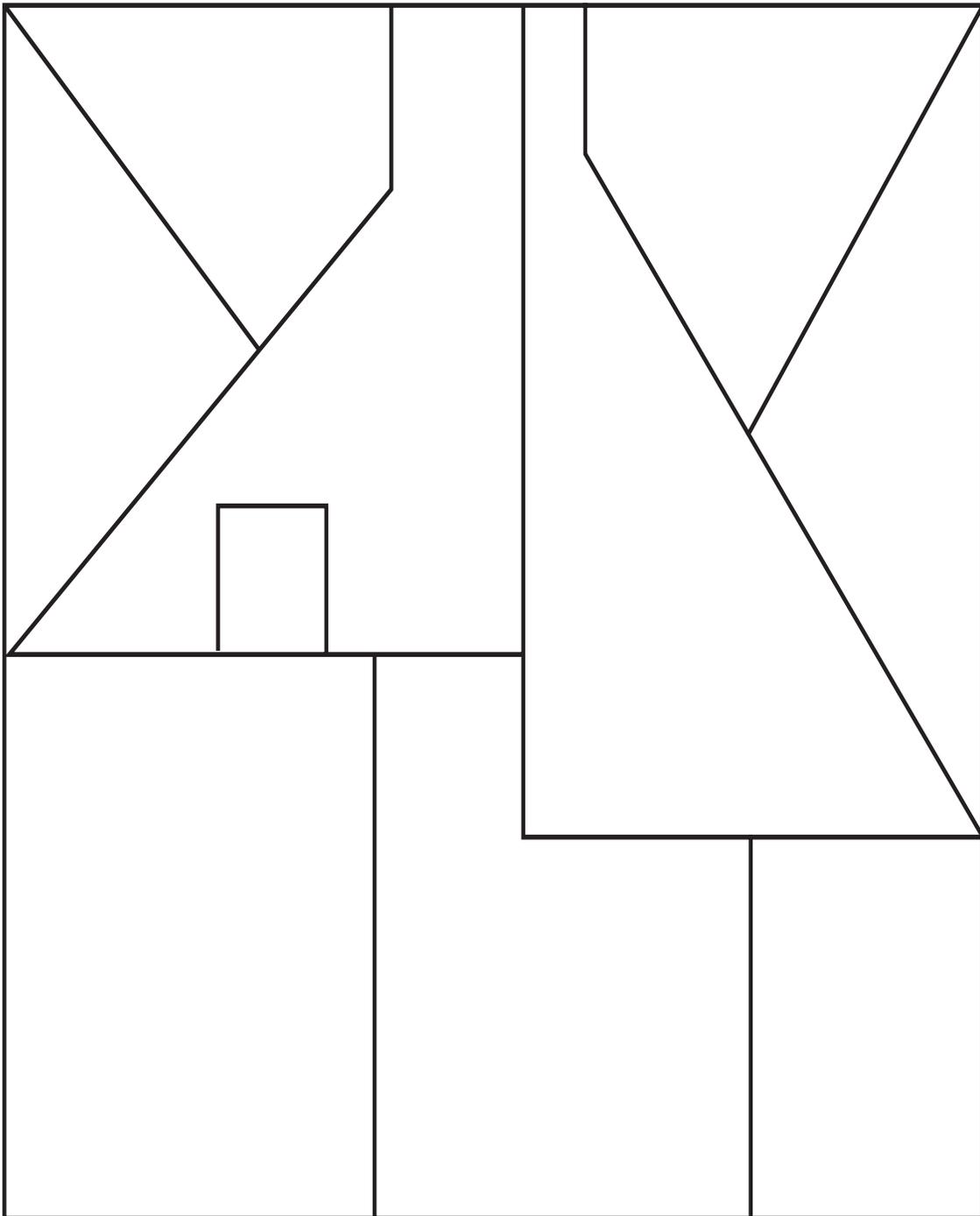
Homework & Family Connections

Students take home a circle, triangle, square, and rectangle and teach their family the lines of symmetry.

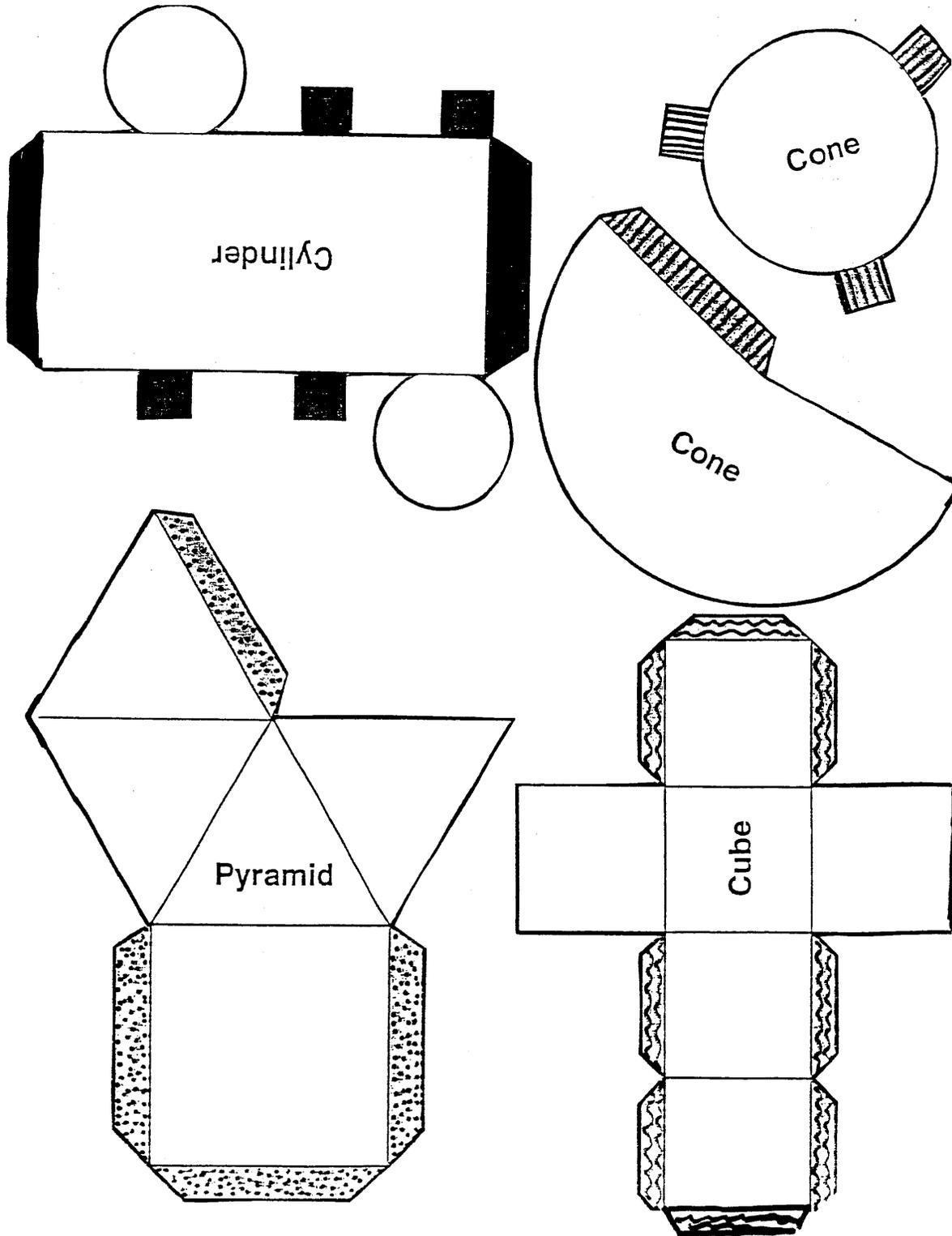
Students use their arms to teach their family acute, obtuse, and right angles. Students play “Simon Says” with their family.

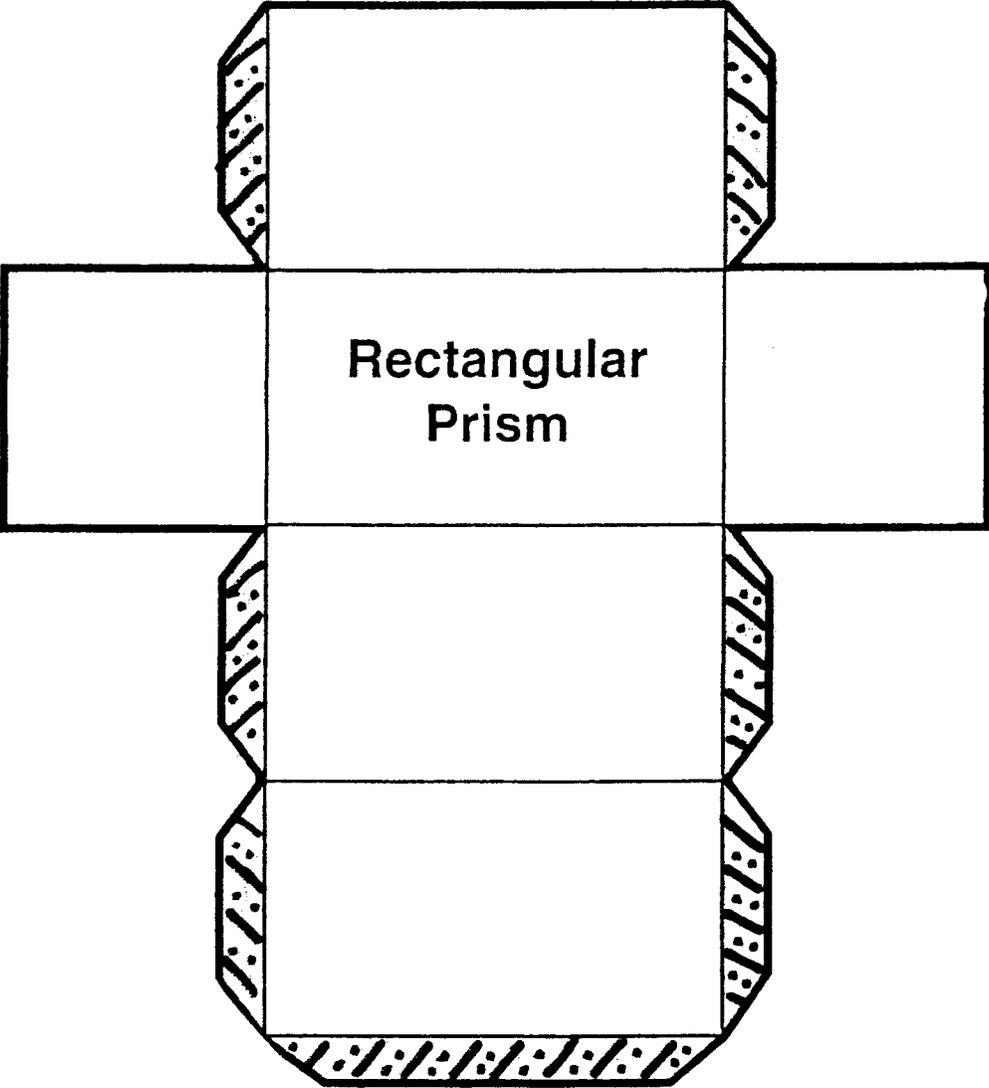
“Shapes Are Everywhere” Design

Choose 3 colors of crayons. Color this design so that no shapes of the same color touch each other. Problem solve first: Think out the design before you color.



Construction Squares





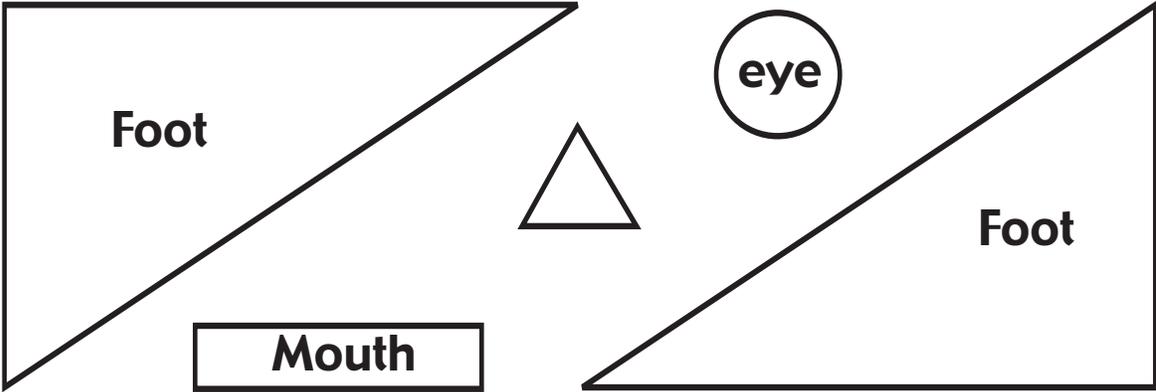
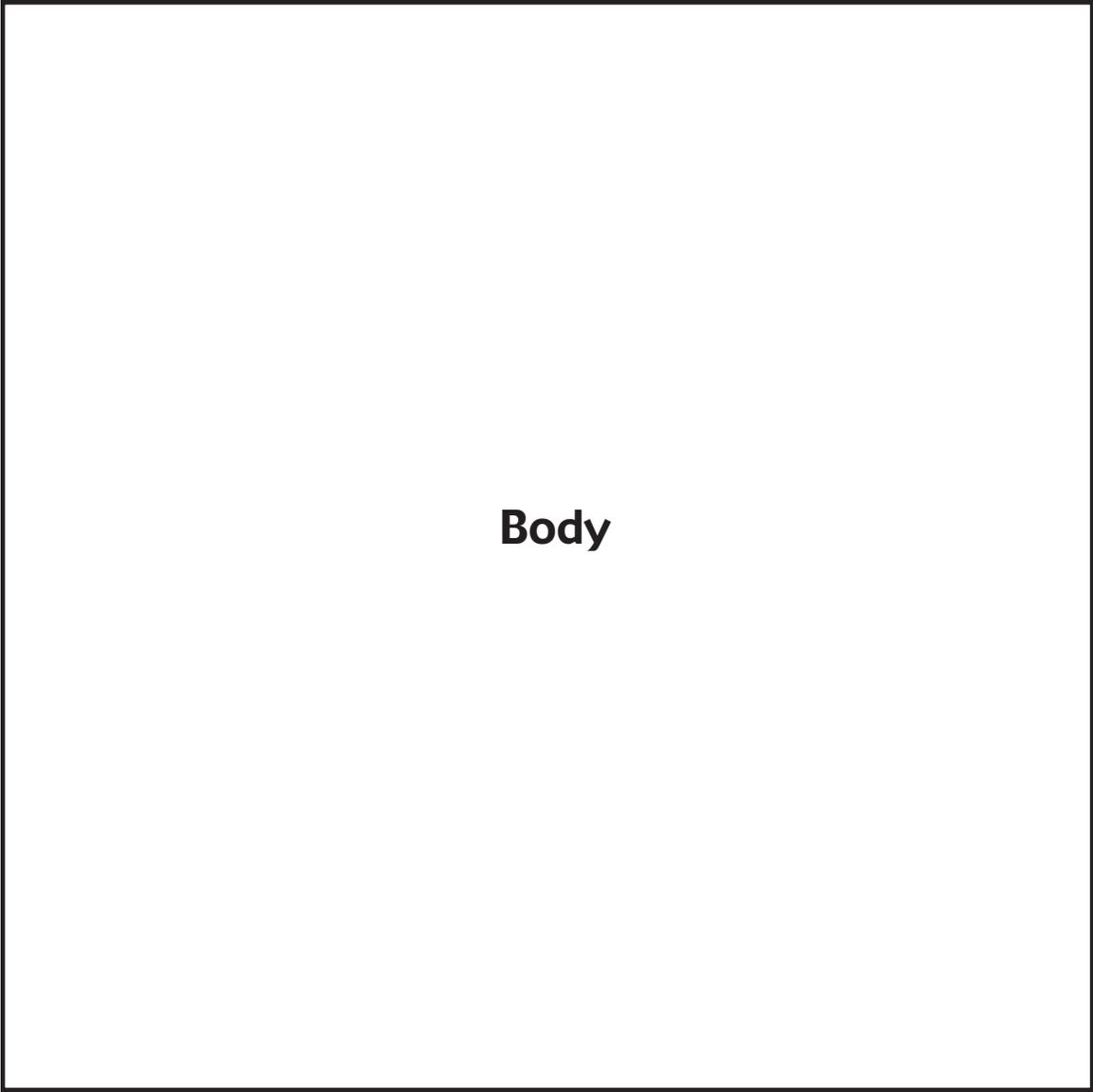
Who Says I'm Square?

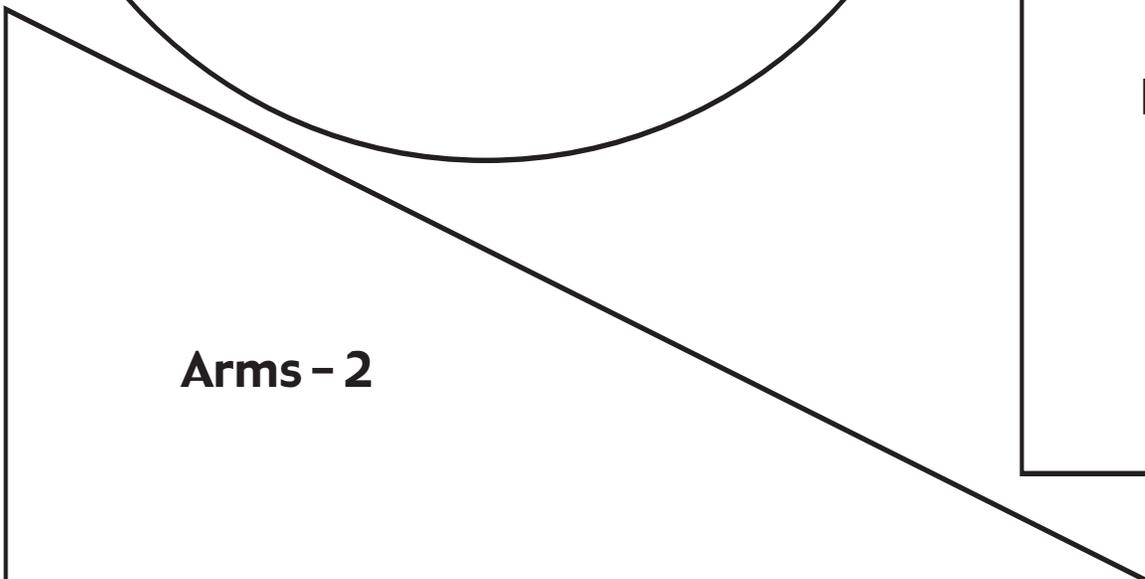
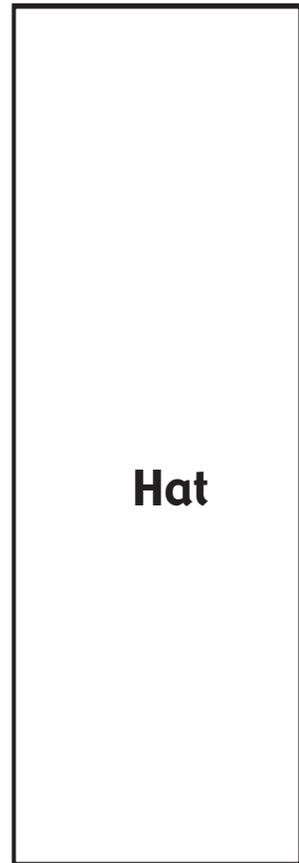
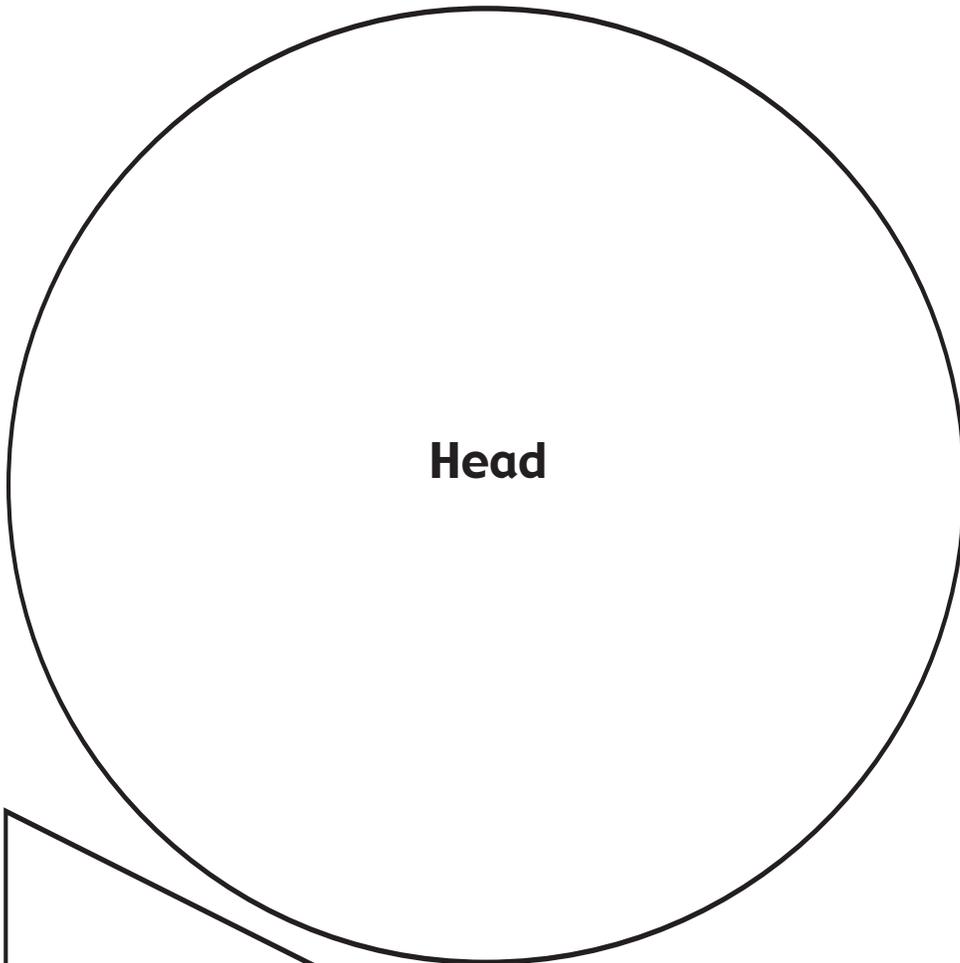
Lets make our geometry "square." We will make him out of construction paper and put him together using paper fasteners (brads). This will make his appendages move.

You will need

Body Part	Geo Shape	Size
Head	Orange Circle	5" diameter
Hat	Green rectangle	4 1/2"x 1 1/2"
Eyes	Blue circles	1/2" diameter
Nose	Yellow triangle	1/2" sides
Mouth	Red Rectangle	1 1/2" x 1/3"
Body	Green square	6"
Buttons	You choose	
Arms	Orange right angles	3" base, 6" altitude
Hands	Red squares	2"
Legs	Yellow rectangles	6" x 2"
Feet	Blue triangles	2" base, 3" altitude

Who Says I'm Square? Body Parts





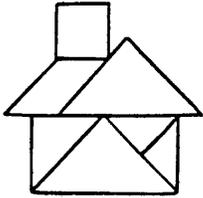
Name: _____

Geometric Addition

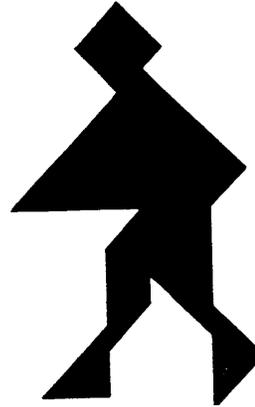


1. One triangle has how many sides?
2. One square has how many sides?
3. One circle has how many sides?
4. 1 square + 1 triangle has how many sides total?
5. 1 triangle + 1 circle has how many sides total?
6. 3 triangles have how many sides in total?
7. 10 triangles have how many sides in total?
8. 5 squares have how many sides in total?
9. 10 circles have how many sides in total?
10. 2 triangles + 2 squares + 2 circles have how many sides in total?

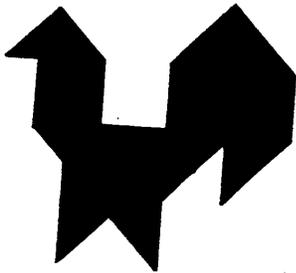
THE HOUSE



THAT JACK BUILT



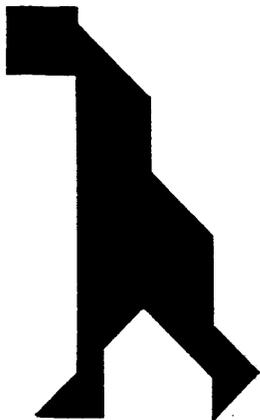
This is THE FARMER
sowing his corn,



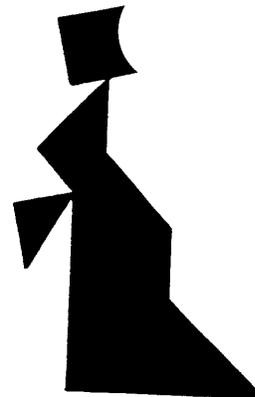
That kept the ROOSTER
that crowed in the morn,



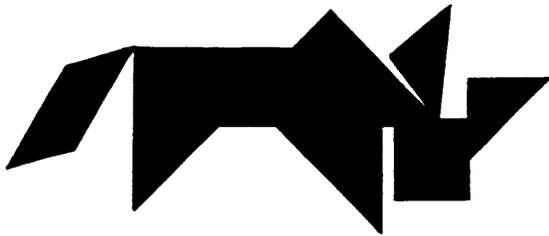
That walked THE PRIEST
all shaven and shorn,



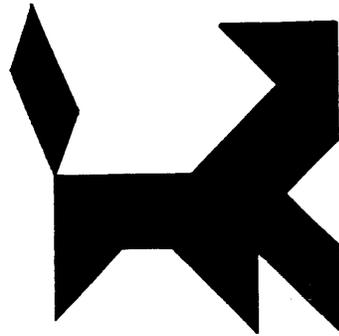
That married THE MAN
all tattered and torn,



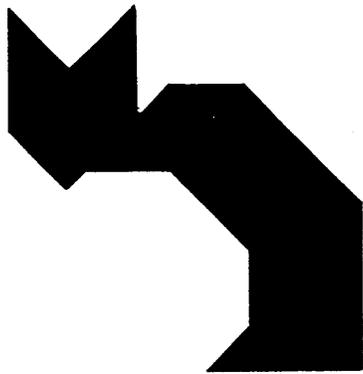
That kissed THE MAIDEN
all forlorn,



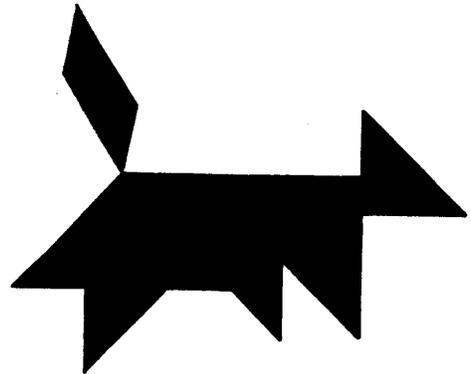
That milked THE COW
with the crumpled horn,



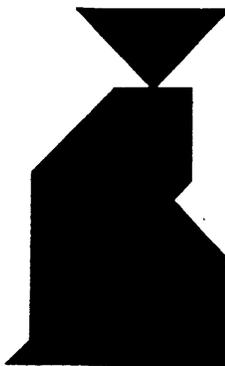
That tossed THE DOG,



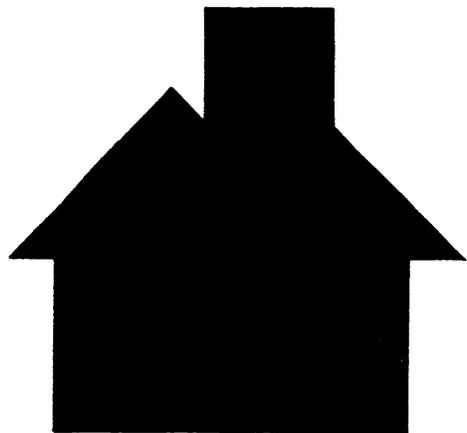
That worried THE CAT,



That killed THE RAT,



That ate THE MALT,



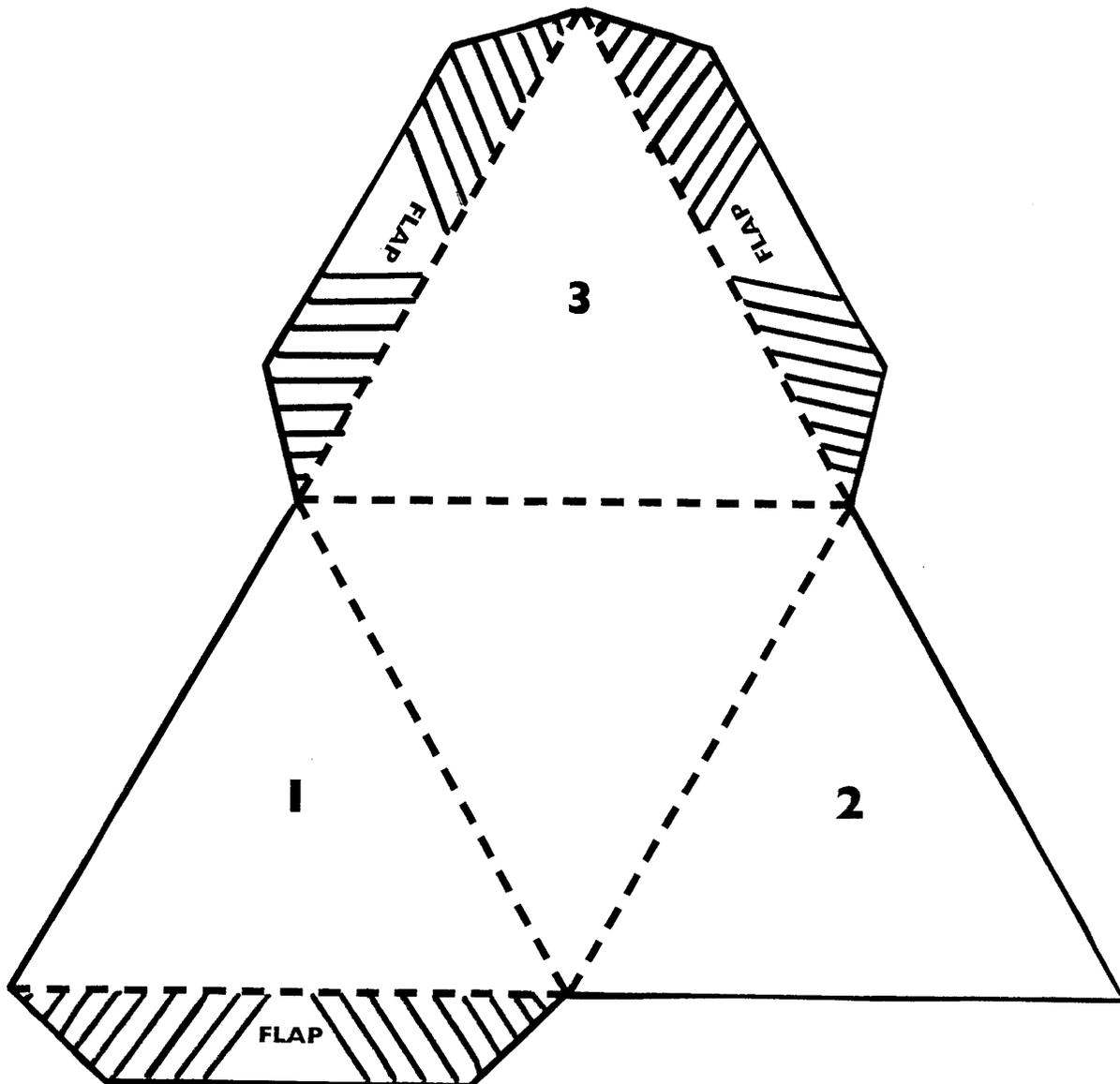
That lay in THE HOUSE
THAT JACK BUILT

Egyptian Treat Boxes (Pyramid)

What you need:

- Pyramid Gift Box Pattern for each student (below)
- Construction paper or any other type of heavy decorative paper
- scissors
- glue or tape

These fun boxes are perfect for holding small treats!



Mirra Activity for Symmetry

Learning Outcomes:

- Recognize symmetry
- Match shapes
- Compare shapes

Materials:

- Mirra or mirrors
- Pattern blocks

Directions:

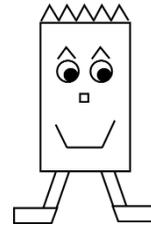
Have students make a shape with a straight side. Put the mirra or mirror on the side. Tell the student to look at the reflection of the design. Have students make the same design on the opposite side.

Something Extra:

Put students in pairs. Have one student make a shape and hide it from his or her partner by putting a barrier between them (like an open folder). Have the student with the pattern blocks make a design, then tell his or her partner, using oral directions, how to make the same shape.

Name: _____

ABC Symmetry



On the chart, write the letters of the alphabet in the right column.

Letters with No Lines of Symmetry	Letters with Onw Line of Symmetry	Letters with Two Lines of Symmetry	Letters with More Than Two Lines of Symmetry

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

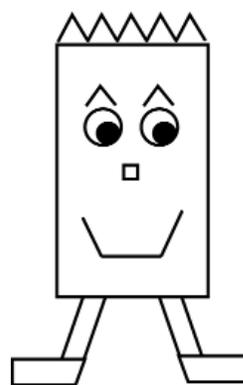
V

W

X

Y

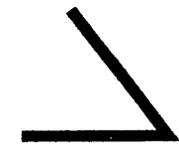
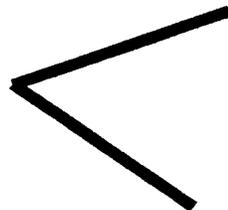
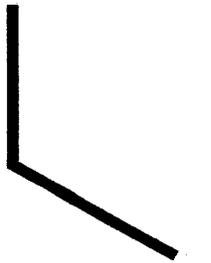
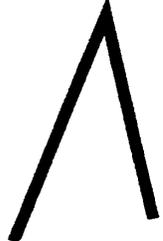
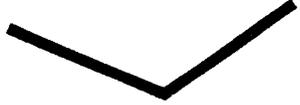
Z



Name: _____

Name The Angle

Write acute, obtuse, or right

Name: _____

Draw These Angles

<p>Right Angle</p>	<p>Acute Angle</p>
<p>Obtuse Angle</p>	<p>A shape with right angles</p>
<p>A shape with acute angles</p>	<p>A shape with obtuse angles</p>

Activity—Let’s Slide, Flip and Turn

Standard III

Objective 2

Connections

Standard III

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

Objective 1

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 towards mathematics.
2. Become mathematically problem solvers
3. Reason mathematically

Background Information

Definitions

transformation: A change in position.

slide (translation): An object that moves up, down or over.

flip (reflection): a mirror image of the object.

turn: The transformation that occurs when a figure is turned a certain angle and direction around a point. A turn is a rotation.

congruent: The condition of being equal in size.

symmetry: A line that divides a figure into two congruent halves that are mirror images of each other.

triangle: A polygon that has three sides

Invitation to Learn

Each student will use 6 polydron squares (or 6 squares and tape) to explore, discover, and connect to form a cube. Students share their discoveries with their team.

Each team will choose 1 net to share with the class by showing and drawing on the chalkboard. Encourage each team to demonstrate one that is different from those already on the board.

Students record all possible nets in their journals and explain why those nets will fold into a cube.

Instructional Procedures

1. Check prior knowledge of students by using overhead magnetic pentominoes to have students demonstrate their knowledge of a flip, slide, turn, and congruence.
2. Teach students vocabulary of transformation which includes a flip (reflection), slide (translation), turn, and congruent.
3. Demonstrate slides, flips, turns, and congruence using a few overhead pentominos.
4. Have students practice slides, flips, and turns using pentomino shapes.
5. Using the chalkboard, a few students will demonstrate their understanding of a slid, flip, turn, and congruence with the magnetic pentomino shapes.
6. Instruct students to trace pentomino pieces in their journal showing 2 slides, 2 flips, and 2 turns.
7. Have students describe a slide, flip, turn, and congruence in their journals.

Curriculum Integration

Science: Relate the motion of turning to the moon phases.

Math: Assemble various nets.

Math: Make polygons by combining other polygons.

Assessment Suggestions

1. Transformation card game allowing students to demonstrate their knowledge by matching slides, flips, turns, and congruence.
2. Students draw various polygons to show a slide, flip, turn, and congruence.

Homework & Family Connections

Have students demonstrate to their families a slide and flip by using pentominoes.

Materials

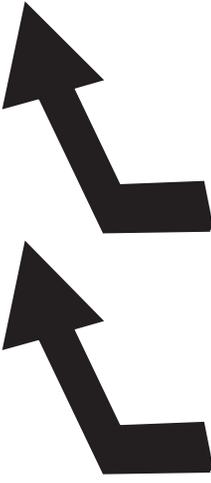
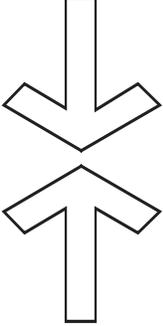
For each team:

- 6 Polydron squares (or 6 squares with tape)

For each student:

- 1 pentomino shape that can be rotated to other teammates
- Pentominoes
- 1 sets of different colors of magnetic pentomino shapes

Let the Arrows Show the Way

slide		to move a figure in one direction
face		a flat surface of a solid figure
turn		to rotate a figure
flip		to turn a figure over

Activity—Where Are We?

Standard III

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

Objective 2

Describe spacial relationships.

Intended Learning Outcomes

1. Demonstrate a positive learning attitude towards mathematics
2. Become mathematical problem solvers
3. Reason mathematically

Standard III

Objective 2

Connections

Background Information

Definitions

coordinates: An ordered pair of numbers that identify a point on a coordinate plane or grid.

point: An exact location in space represented by a dot.

location: A plot that shows a position or place using boundaries.

horizontal: A line that is parallel to the horizon.

vertical: A line that has right angles to the horizon.

Invitation to Learn

Working with partners, have students give instructions to his partner to locate a drinking fountain, restroom, etc. in the school. The students will actively engage themselves in learning where and how to locate places on a map or grid using coordinates.

Instructional Procedures

1. Define coordinates and demonstrate to the class where to locate the coordinates “A” and “1” on a overhead graph. Instruct students to write all definitions you provide in their journals.
2. Horizontal and vertical lines: Ask students if, when they watch television, they ever see horizontal or vertical lines. Demonstrate, with your hands and the board examples of vertical and horizontal.
3. Have students use the same graph as the overhead to locate teacher requested points (places) on their grids and draw what you direct them to do.

Materials

- graph paper
- overhead of grids showing “A” and “1” axis.
- jelly beans
- “Jelly Bean Fun” activity sheet

4. Instruct students to plot and answer questions about their “Jelly Bean Fun” activity. They can do this activity in groups, pairs, or on their own.

Assessment Suggestions

Give students a skill sheet and, using two colors have them show the difference between horizontal and vertical lines.

Allow students to make and design t-shirts showing patterns of horizontal and vertical lines.

Using a graph with coordinates, students should be able to plot answers.

Curriculum Integration

Math/Science—Record data from a science experiment by taking the students outside with a large piece of string and make a “A” axis and an “1” axis. Instruct them to graph what they observe that is living and nonliving. Return to the classroom and have the students use a graph paper to plot their results.

Possible Extensions/Adaptations/Integration

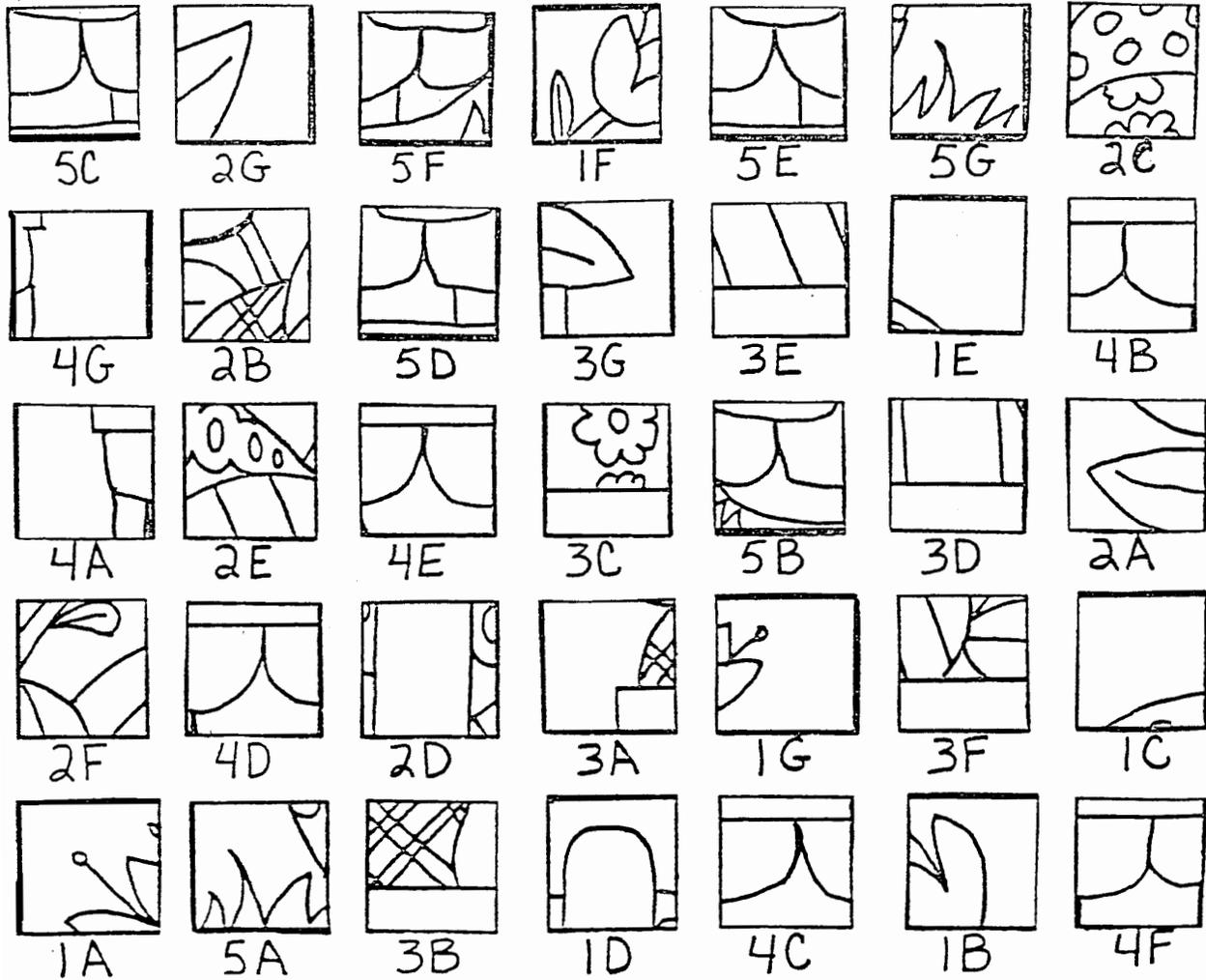
Have children in a cooperative group make a graph and coordinates and then exchange it with another group to do the activity.

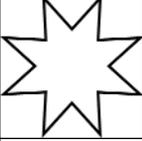
Homework & Family Connections

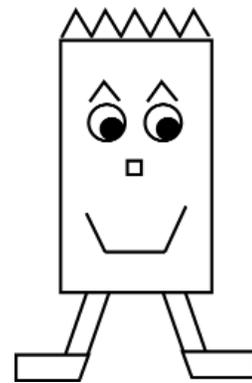
Have students draw their room using graph paper, making horizontal and vertical lines and plotting their bed, dresser, closet etc.

Spring Time Art

Each square contains one part of a complete picture. Copy each square into the empty square with the same number. When you have drawn in each square, all the squares together will make a picture for Easter.

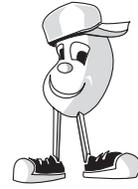


	A	B	C	D	E	F	G
1							
2							
3							
4							
5							



Name: _____

Jelly Bean Math



Estimate how many jelly beans are in your baggy _____

Colors	Estimate	Tallies	Coordinates
Red			
Yellow			
Green			
Purple			
Black			
Orange			

Jelly Beans

Answer the following:

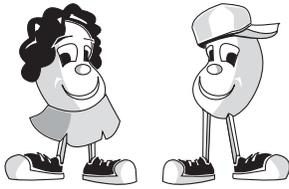
Total number of jelly beans in your baggy? _____

Which color of jelly beans do you have the most of? _____

Which color do you have the least of? _____

What is the difference between the two? _____





Jelly Bean Fun

Use your jelly beans to show sets of tens and ones.

Red	tens _____	ones _____	Purple	tens _____	ones _____
Yellow	tens _____	ones _____	Black	tens _____	ones _____
Green	tens _____	ones _____	Orange	tens _____	ones _____

Make and then draw a pattern with two colors of Jelly Beans.

Make and then draw a pattern with three or more colors of Jelly Beans.

Compare your numbers using a < or > or = sign.

- | | |
|-----------------------|------------------------|
| 1. yellow _____ green | 4. orange _____ red |
| 2. red _____ orange | 5. purple _____ green |
| 3. green _____ black | 6. yellow _____ purple |

Fill in complete the following addition problems:

- | | |
|---------------------------------------|---------------------------------------|
| 1. yellow _____ + green _____ = _____ | 4. red _____ + green _____ = _____ |
| 2. red _____ + orange _____ = _____ | 5. orange _____ + green _____ = _____ |
| 3. black _____ + purple _____ = _____ | 6. yellow _____ + black _____ = _____ |

***Science
Standard I
Activities***

Activity—Comparing the Earth and Moon

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.

Intended Learning Outcomes

1. Use a Science Process and Thinking Skills
2. Manifest Scientific Concepts and Principles
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Standard

I

Objective

1

Connections

Background Information

Earth is a small planet, third from the sun in our solar system. Earth's shape is spherical, the result of gravity pulling Earth's material toward a common center. Earth's surface is mostly rock, with three-fourths of the surface being covered in water. The gravitational pull of Earth's mass is enough to hold on to an atmosphere of natural gases. This atmosphere has evolved as a result of changing conditions on Earth's surface and the evolution of plant life. The atmosphere on Earth is a major component of our global ecosystem. Water exists as liquid, solid, and gas.

The moon is about 1/4 the diameter of Earth. Craters, bowl-shaped depressions formed where meteorites have struck, mark its landscape. Rough, mountainous highlands and flat plains are its basic surface regions. The moon surface reflects light from the sun.

Invitation to Learn

Read the first riddle clue to the class (or have individual cards made for each clue), and have them write down what they think it might be. Read the next clue and have them write down what they think it might be. Continue doing this until you have read all of the clues. Discuss their final answer.

Instructional Procedures

1. Hand out moon journal.
2. Have students write down what they think the moon is made of? What do they think is on the moon? And what is the shape of the Earth and moon?

Materials

- Riddle
- Moon Journals
- Poster of the Earth and moon
- What the Moon is Like* by Franklyn M. Branley

3. Divide the class into small groups and have them look at the poster of the moon and Earth and list the ways they are alike and different in their moon journals.
4. Read *What the Moon is Like* to the whole class and then have them work with their groups (or as a whole class) to add items they learned from the book in their journals.

Curriculum Integration

Math/Science—Define sphere: round like a ball.

Assessment Suggestion

Response Questions

- What is on the moon?
- How are the moon and the Earth alike? Different?
- What shape are the moon and Earth?

Additional Resources

Websites

- www.nasa.org
- www.earthsky.com
- www.sciencecourt.com
- www.askjeeves.com
- www.astronomy.com/content/static/AstroForKids
- www.childrenmuseum.org/cosmicquest
- www.faahomepage.org/main.html
- www.jsc.hasa.gov/poa/students
- www.pbs.org/wgbh/nova/worlds
- http://www.moisd.k12.mi.us/Gen_Ed/Outreach/Starlab/plans.htm
- http://www.moisd.k12.mi.us/Gen_Ed/Outreach/Starlab/plans.htm
- <http://spacelink.nasa.gov/Instructional.Materials/Curriculum.Support/Space.Science/Our.Solar.System/Earth's.Moon/.index.html>
- http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/moon.html
- http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level2/moon.html
- <http://seds.lpl.arizona.edu/nineplanets/nineplanets/luna.html>
- <http://www.harmsy.freeuk.com/moon.html>
- <http://www.fourmilab.ch/earthview/vplanet.html>
- <http://www.fearofphysics.com/SunMoon/sunmoon1.html>
- <http://www.moonlink.com>

Books

What the Moon is Like by Franklyn M. Branley

All About the Moon by Wes Lipschultz

When You Look Up at the Moon by Allan Fowler

So That's How the Moon Changes Shape! by Allan Fowler

The Moon Seems to Change by Franklyn M. Branley

The Moon Book by Gail Gibbons

Moonwalk The First Trip to the Moon by Judy Donnelly

Magic Tree House Research Guide Space by Will Osborne and Mary

Pope Osborne

Magic Tree House Midnight on the Moon by Will Osborne and Mary

Pope Osborne

The Moon by Seymour Simon

The Earth by Seymour Simon

Jimmy Zangwow's Out-of-this-World Moon Pie Adventure by Tony

DiTerlizzi

Video

Space Science for Children All About The Moon Schlessinger

Homework & Family Connections

Students can tell their families how the moon and Earth are alike and different.

Read books about the Earth and moon.

Send home a list of websites and encourage students to look them up with their families.

Riddle

This object is part of the solar system.

It is smaller than the Earth.

It is usually seen at night.

It has holes called craters on its surface.

It goes around the Earth.

It seems to change shape on different nights.

If you look up at night, you will probably see it.

(*Exploring Space*, Evan Moor, 1998, pg. 51)

My Moon Book Moon Words

appearance

axis

model

moon

orbit

revolution

rotation

sphere

How are the moon and earth **alike**?

Moon

Earth

What do you **think** the moon is made of?

Do you **think** there is anything on the moon?

How are the moon and earth **different**?

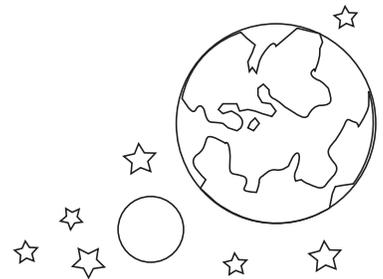
Moon

Earth

What do you **think** there is?

The moon is really made of what?

Draw a picture of what is on the moon.



How do you **think** we get day and night? Why does the moon change shape?



Tell how we get day and night. Draw a picture. The moon changes shape because...

Where do you **think** the moon gets its light from?

Who do you **think** we see different star patterns in the night sky?

Draw how the moon gets its light.

We see different patterns in the night sky because...



Activity—How are Moon Craters Made?

Standard

I

Objective

1

Connections

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.

Intended Learning Outcomes

1. Use a Science Process and Thinking Skills
2. Manifest Scientific Concepts and Principles
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Background Information

Big rocks from space hit the moon, leaving holes called craters. The moon is made up of lots of gray. There are no animals and plants because there is no usable water or air. What are those light and dark areas on the moon's surface? The light areas are highlands or mountains. The dark areas are flat, low plains. Most of the small craters on the moon were formed by the impacts of meteoroids crashing into the moon's surface. The larger craters were probably formed by larger celestial bodies (like asteroids and comets) hitting the moon's surface. The largest crater on the moon, the *Imbrium Basin*, is 700 miles wide.

Invitation to Learn

How do you think craters are formed on the moon? Where do you think the rocks come from that crash into the moon? Why are there so many craters on the moon? Have students record their answers in their moon journals.

Instructional Procedures

1. Put the soil, sand, or flour in the pan.
2. Hold a rock over the pan (about as high as your chin).
3. Drop the rock.
4. Lift it out carefully so that you do not change the shape of the crater. Repeat with different size rocks, smoothing the sand before each try.
5. Repeat this procedure holding the rocks at different heights.
6. Record discoveries.

Materials

- soft soil, sand, or flour
- shallow pan
- several rocks of different sizes
- moon journal

Possible Extensions/Adaptations

Art

Have students use a plastic sandwich bag and use it to apply gray tempera paint to cover an eight-nine inch square. After it dries, cut out a circle.

Glue moon cutout onto the larger black paper and cut out white stars to add to the picture.

Writing

For a writing activity that is out of this world, tell students that many stories have been told about the shapes on the moon's surface. A well-known story states that the moon shows the face of a man ("The Man in the Moon"). Have each student study her or his project and write about what she or he sees on the moon (refer back to the *What the Moon is Like* by Frankly M. Branley).

Assessment Suggestion

Students can describe what they did, what they saw, and what they learned in their journals.

Homework & Family Connections

Students conduct the same experiment with their families, explaining what they learned.

Share moon stories with their families.

Send home a list of websites and encourage students to look up with their families.

Read books about the Earth and moon.

Materials

- gray tempera paint
- seven inch circle cut out of black construction paper
- plastic sandwich bags.
- 9 x 12 black construction paper and white paper to make stars

Activity—What is Moonlight?

Standard

I

Objective

1

Connections

Standard I

Students will understand that the shape of Earth and the moon are spherical and the 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.

Intended Learning Outcomes

1. Use a Science Process and Thinking Skills
2. Manifest Scientific Concepts and Principles
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Background Information

The moon shines by reflecting sunlight. Like Earth, half of the moon is always lighted by the sun's direct rays, and the other half is always in shadow. The moon has phases because, as the moon travels around Earth, different parts of its bright side are seen from Earth. Without the sun, there would be no moonlight.

Invitation to Learn

While your students are out of the classroom, set up a mirror so that it catches the sun and reflects a bright spot of light onto a conspicuous classroom location. When the students return and notice that reflection, ask them what could be causing the bright spot of light. After a short discussion, direct their attention to the mirror. Find out how many students think the mirror is the source of the light. Next, move the mirror out of the sun's path and turn off the lights in the room. After the students have noted that the mirror makes no light, shine the flashlight onto the mirror. Guide students to conclude that the mirror makes no light of its own; however, light can bounce off (or reflect from) the mirror, causing it to shine.

Instructional Procedures

1. Ask the students the following questions or have them record answers in their journals.
 - Where does the moon get its light?
 - If the moon has no light of its own, why does it appear to shine and glow at night?
 - What do you think shines on the moon?

Materials

- flashlight
- mirror
- globe or balls
- moon journals
- meter sticks

2. Class demonstration-give each student an opportunity to help. Make a triangle with two sides about 2 meters long.
3. Three students stand at the different corners of the triangle. One student holds the flashlight, one holds the globe, and one holds the mirror.
4. Turn out the lights. Observe the globe.
5. Turn on the flashlight and shine the light on the mirror. Hold the mirror so the light is reflected to the globe or ball. (Caution students about shining the light in other students eyes.)
6. The flashlight represents the sun, the globe or ball is the Earth, and mirror is the moon. The moonlight we see from the Earth comes from the sun.

Curriculum Integration

Math/Science—Measuring with meter sticks.

Assessment Suggestion

Students write or draw how the moon gets its light.

Homework & Family Connections

Conduct the experiment at home, explaining how the moon appears to have light.

Read books about Earth and moon.

Send home a list of websites and encourage students to look up with their families.

Activity—Day and Night

Standard

I

Objective

2

Connections

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 2

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

Intended Learning Outcomes

1. Use a Science Process and Thinking Skills
2. Manifest Scientific Concepts and Principles
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Background Information

The student will demonstrate how the rotation of Earth's axis produces the night and day cycle. Earth revolves around the sun about every 365 days. Earth makes one complete rotation on its axis each day, or every 24 hours. During this rotation, half of Earth is facing the sun, experiencing day, while the other is away from the sun, experiencing night.

Invitation to Learner

Have students answer questions in their journals about how we get day and night. Discuss with the class what they wrote in their journals.

Instructional Procedures

Day and Night Cycle

1. Put the sticker on the globe to indicate where you live.
2. Place the globe on a table, then turn the lights off.
3. Have a student shine the flashlight on the globe where the sticker is.
4. Ask students if it is day or night where the sticker is located.
5. Turn the globe counterclockwise until the sticker is away from you.
6. Shine the light on the other side. Students will notice the sticker is now on the dark side, which represents night time.

Materials

- globe
- flashlight
- sticker
- moon journals
- 3x5 pieces of paper

Earth and Moon in Motion

Help students visualize how the Earth and the moon travel together in space with this enactment. Review what orbit means: the path an object in space follows as it revolves around another object. Review what revolve means: to spin around an object.

1. Divide the class into groups of three.
2. Give each group three cards and have them write “Sun”, “Moon”, and “Earth” on the cards. Students can also draw a picture of the word they wrote.
3. Take the class outside or to a large open area.
4. Have a group come to the middle and position the sun performer and explain that, like the real sun, he will not move. Have the child acting as Earth revolves very slowly around the sun and then have the moon impostor revolve around the moving Earth. Explain that while it takes the Earth about 365 day to orbit the sun, it takes the moon only about 29 1/2 days to orbit Earth.
5. Have the remaining students form groups and enact the cycle.
6. After students come back to the classroom, pass out the activity “Earth, Moon Orbits,” students color, cut out, and assemble.

Possible Extensions/Adaptations:

Art—Day/Night clock

1. Ask students to draw what they do at night on one side of the clock.
2. Ask students to draw what they do during the day on the other side of the clock.
3. Tell students to draw several activities on each side of the clock.

Science

1. Ask students if they think animals have things they do during the day and other things they do at night.
2. Ask students what activities happen as a year goes by.

Language Arts

1. Start telling a story about a child playing in a park or starting the day preparing to go to school.
2. The story begins as the day is beginning.
3. Go around the circle with each student adding something imaginary that the child is doing.

Materials

- white paper plates or clock faces drawn on paper

4. Encourage the story line to go in chronological order from day into night.
5. Write responses to make a class book.
6. Have students illustrate their response.

Assessment Suggestions

Have the students write in their journals how we get day and night with illustrations.

Why do we have a year?

Write down the definitions in their journals.

Homework & Family Connections

Conduct the same experiment at home with their families.

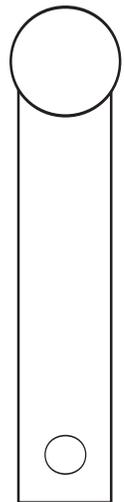
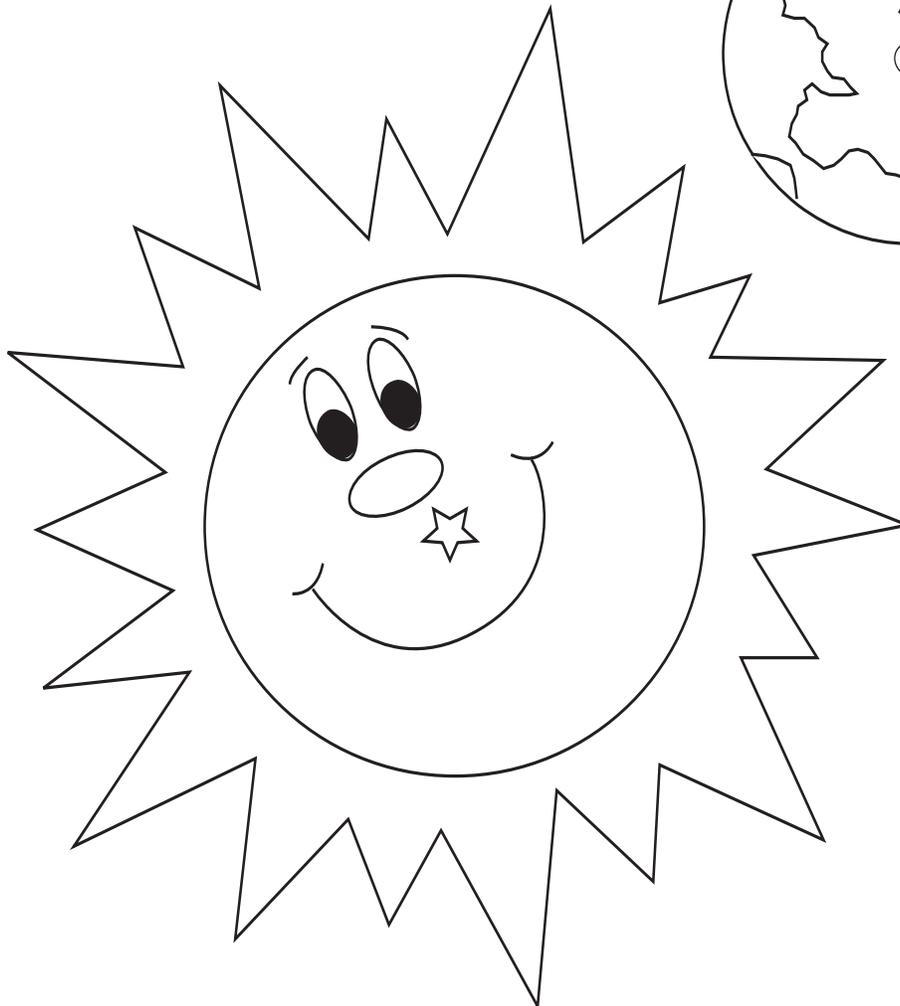
Read books about the moon and Earth.

Send home a list of websites and encourage students to look them up with their families. Share with their family the “Earth, Moon Orbits” activity.

Earth, Moon Orbits



1. Color the earth, the moon, and the sun.
2. Cut out the pictures.
3. Punch a hole in each strip at the ☆ and the ○.
4. Push a brad through the ○ in the center of the earth picture and through the hole in the moon's strip. Open brad.
5. Push a brad through the ☆ in the center of the sun pattern and through the hole in the earth's strip. Open brad.
6. Show the orbits of the moon and the earth by moving the patterns around the sun.



Activity–Moon Phases

Standard

I

Objective

2

Connections

Standard I

Students will understand that the shape of Earth and the moon are spherical and the 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. Use a Science Process and Thinking Skills
2. Manifest Scientific Concepts and Principles
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Background Information

Every 29 1/2 days, the moon goes through a complete cycle. The moon begins the cycle being apparently invisible. This happens when the moon comes between the sun and Earth, so that sunlight only shines on the back side of the moon where we can't see it. As the moon moves around Earth, we see more of the sunlit part of the moon. Halfway through the cycle, we see a full moon. At that time, the whole face of the moon is lighted by the sun. Then we see less and less of the moon until finally, it disappears again. Waxing means “appears to be growing” and waning means “appears to be shrinking”.

Materials

- poster of moon phases
- empty Pringles can
- moon phase booklet or worksheet
- black construction paper
- several quarters for students to trace or make moon phase patterns for students to trace
- scissors
- stapler
- The Moon Seems to Change* by Franklyn M. Branley or
- Where Does the Moon Go* by Sidney Rosen
- moon journals

Invitation to Learn

Why does the moon seem to change? Have students record their response in their moon journals.

Instructional Procedures

1. Read *The Moon Seems to Change*.
2. Discuss why the moon changes and have students record any new insights they gained into their journals.
3. Pass out black paper on which students can trace the lid of their Pringles can.
4. Give students a quarter or a pattern of a small circle.
5. Have students trace 4 smaller circles inside their larger circle.
6. Students should draw a full, gibbous, first quarter, and crescent moons onto the small circle.

7. Have them carefully cut out their moons.
8. Poke a hole in the bottom of the can.
9. Have students place one of their moon patterns in the lid of the can and replace the lid. As they hold it up to the light and look through the hole, students will be able to observe the phases of the moon (change out patterns).

Possible Extension/Adaptations

Art

1. Give each student a drawing paper.
2. Students fold the paper into fourths.
3. Students sit in a circle around a large object with a handle (mug, pitcher, soup tureen, etc.) and sketch what they see from their angle in the first box on their paper.
4. Students move counterclockwise one quarter of the way around the circle.
5. Students sketch what they see from this angle in the next box on their paper.
6. Repeat steps 4 and 5 two more times.

Language Arts

Share the poem “Moon Over My Cookie” while students eat their own cookies.

Art–Moon Phase Spinner

1. Students draw and color a picture of their home on one plate.
2. Students cut a triangle or circle out of the top of the paper plate that they drew their home on. You may want to provide a pattern for this.
3. Students glue the moon phases onto the second paper plate.
4. Put the two plates together with the brad.

Materials

- two larger paper plates per student.
- one brad fastener per student.
- copy of moon phases for students to look at.

Assessment Suggestions

Students write in their journals how the moon changes shape.

Students make a moon viewer.

Students record the different phases of the moon for a month.

Homework & Family Connections

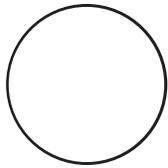
Students take home moon phase books or paper and record the dates of each phase of the moon.

Students share with their families their moon viewers.

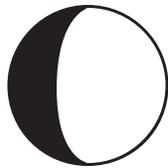
Read books about the moon and Earth.

Send home a list of websites and encourage students to look these up with their families.

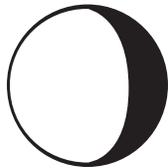
Moon Over My Cookie



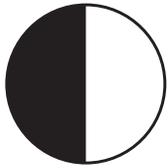
When the **full moon**'s big and bright and round;
When you look up and it's easily found.
We see the entire sunlit side during this phase of the route;
These are the nights that the werewolves came out.



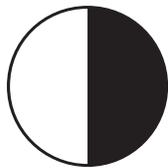
Waxing gibbous is one of the phases before the new moon;
It's still bright enough to light up my room.
Nibble that cookie till it looks like the man in the moon's belly;
He's been eating too much green cheese and jelly.



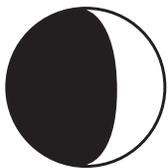
Quickly turn your cookie over, but don't take a bite;
For the **waning gibbous** you now have in sight.
I'm the grandmother moon, light yet dark;
I give off enough light for a night stroll in the park.



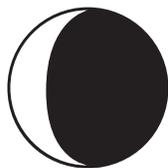
Flip that cookie over and eat it half gone;
But only to the halfway mark and don't go beyond.
This is the **first quarter** that looks like the big letter D;
It's pulling at the water to make a high tide sea.



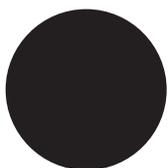
Turn your cookie over and take a little gaze;
For this is the **last quarter** in the moon's phase.
I am half gone ... but yet half here;
I look like the first quarter's reflection in the mirror.



Turn the cookie over and eat it into a smile;
The moon is away from the earth thousands of miles.
Shhhhh, be quiet and don't make a peep;
I'm the **waxing crescent** that'll cradle you to sleep.



Switch the cookie around until I look like a C;
C is for cookie that's good enough for me.
I'm the **waning crescent** a sliver in the sky;
I'm almost gone so wave bye-bye.



Now eat your cookie, don't leave a dot;
Don't feel uneasy knowing I'm there ... but not.
I'm without moondogs, the **new moon**, the dark moon;
But watch closely—I'll be back soon.



new



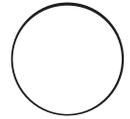
**waxing
crescent**



**first
quarter**



**waxing
gibbous**



full



**waning
gibbous**

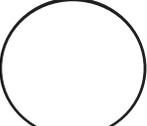


**last
quarter**

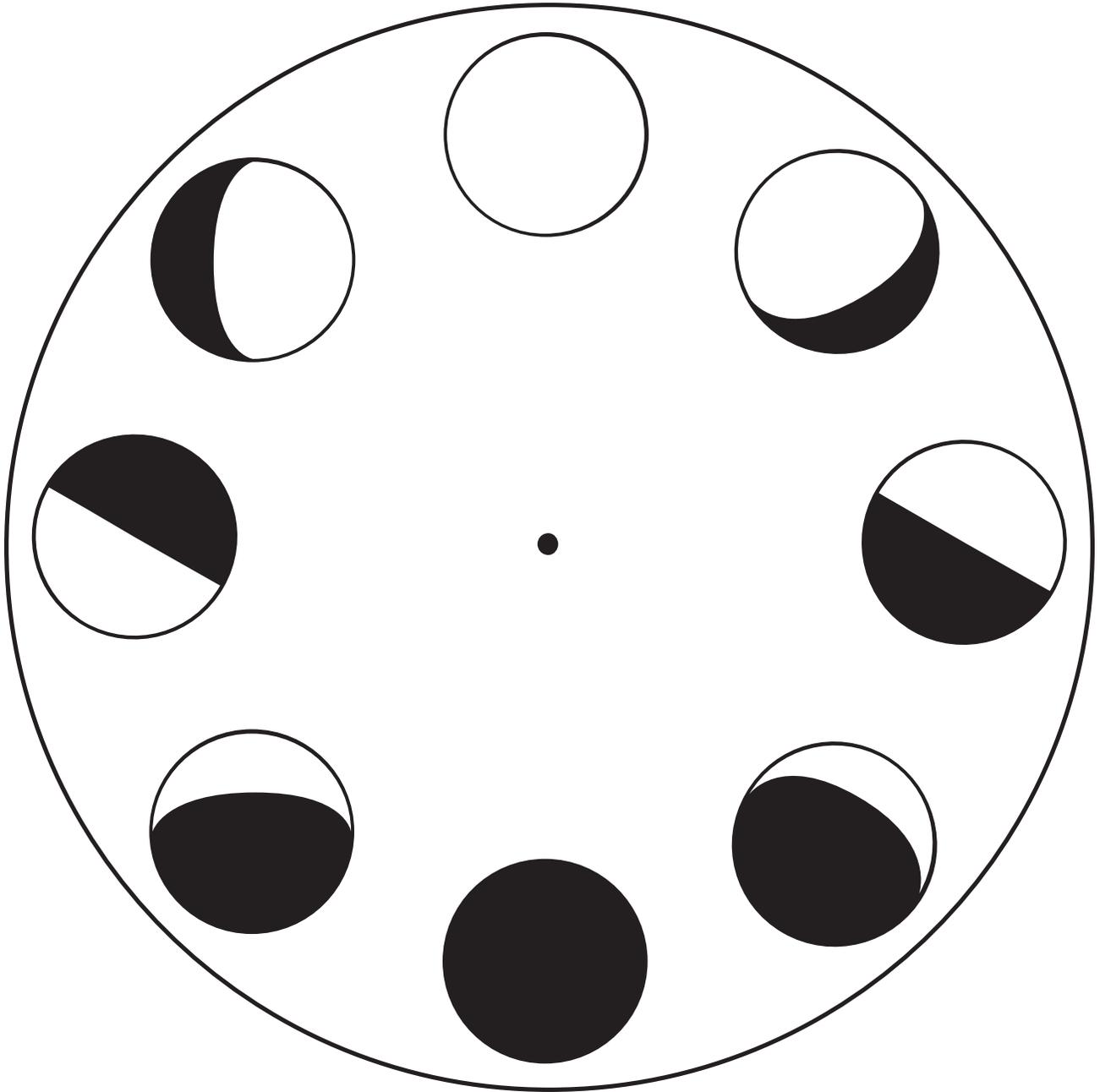


**waning
crescent**

—Lindy Stauffer

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<h1 style="text-align: center;">PHASES OF THE MOON</h1>		 new moon	 crescent	 quarter moon	 gibbous	 full moon

Moon Spinner



Activity–Celestial Model

Standard

I

Objective

2

Connections

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 2

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

Intended Learning Outcomes

1. Use a Science Process and Thinking Skills
2. Manifest Scientific Concepts and Principles
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Background Information

The Earth rotates on its axis at a rate of one full turn per day. This motion is what makes day and night. The daily rotation also causes observers (people) on Earth to see a changing star field as they look at the sky. It's not that the sky is moving, but that Earth moves relative to the sky.

Invitation to Learn

1. What would you see if you were standing on the globe looking up into the night sky? (the stars)
2. Write rotation and axis on the board. Review with the students the fact that Earth is constantly rotating, or spinning, on its axis. Earth makes one full turn every day.

Instructional Procedures

1. Students answer question in their moon journal. Why do we see different star patterns or constellations in the night sky? Discuss their responses.
2. Show students the Celestial Model. Turn the wire in the model and have students watch as the globe turns. Remind the students that the Earth rotates in one direction only.
3. Ask, "In what direction should we rotate our Celestial globe"? (from left to right)
4. Ask, "As the globe rotates, does the sky move"? (No)

Materials

- Celestial Model
- Moon Journals

5. Ask, “Then why do you think we see the sky change during the night”? (Students may realize that because they are moving, the fixed sky appears to be moving)
6. Have students write the correct answer in their journals about why we see different star patterns at night. (The Earth rotates underneath us. This makes it look like the sky is turning, when really it stays still and we turn.)

Possible Extensions/Adaptations

Study different constellations.

Homework & Family Connections

1. Encourage students to imagine themselves standing on the model Earth globe tonight as they observe the stars with their family. Rather than imagining the stars moving past them, have students imagine themselves moving past the stars.
2. Students explain to their families how the Earth is moving not the sky.
3. Read books about constellations.

Science
Standard II
Activities

Activity—Introduction to Living and Nonliving

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 science process and thinking skills
4. Communicate Effectively

Standard II

Objective 1

Connections

Background Information

Your students may have trouble distinguishing between living, nonliving, and once-living things. Children may consider everything that moves to be alive, including cars and clouds. Often children pretend that objects are alive so that they can talk to them. Children also have difficulty comparing once-living objects with objects that have never lived. Living and nonliving are scientific terms. Children are more used to hearing living or dead. By exploring various objects and organisms, your students can begin to distinguish between things that are living, things that were once-living, and things that are nonliving.

Invitation to Learn

Tell the class that you are going to do two demonstrations. You want them to make close observations and be prepared to explain what they saw happen during each demonstration.

Demonstration 1

1. Fill the baking dish with about 1/2 inch of water and place it on the overhead projector. Use 2 opened file folders as a screen to block students' view of the baking dish sitting on the projector.
2. Out of view of the students, behind the screen made from the file folders, sprinkle enough pepper onto the surface of water so that it is pretty well covered. Turn on the overhead projector. Your students will see the paper as shadows on the screen.
3. Place a drop of liquid dish soap on the surface of the water. Your students should see the shadows of the pepper flakes immediately move away from the soap toward the sides of the dish.
4. Ask students to explain what they observed happening and what they think the little things floating on the water are. Why did they move away? Do they think the little things are alive?

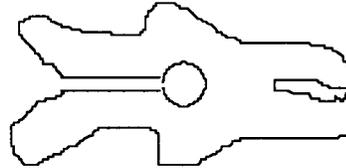
Materials

- small, flat-bottomed, clear glass baking dish
- overhead projector
- pepper shaker
- liquid dish soap
- word cards

Demonstration 2

Thoroughly rinse out the dish before beginning the second demonstration.

1. Place the dish on the overhead and fill it with 1/2 inch of water. Again use the folders to screen your actions from your students.
2. After the water has stopped moving, place a shape similar to the one shown below cut from oaktag, on the surface of the water.



3. Place a drop of liquid dish washing soap in the center hole. Your students will see the shape move quickly across the water.
4. Discuss with the class what happened to the shape. Why do they think the shape moved? Is the shape alive?
5. Explain to the class that the demonstrations did not have any living things in them. Show them the pepper, oaktag shape, and soap. Explain that the pepper and the shape moved away from the soap because it broke the surface tension of the water. Not everything that moves is alive. Have the class list things that move that are not alive.

Instructional Procedures

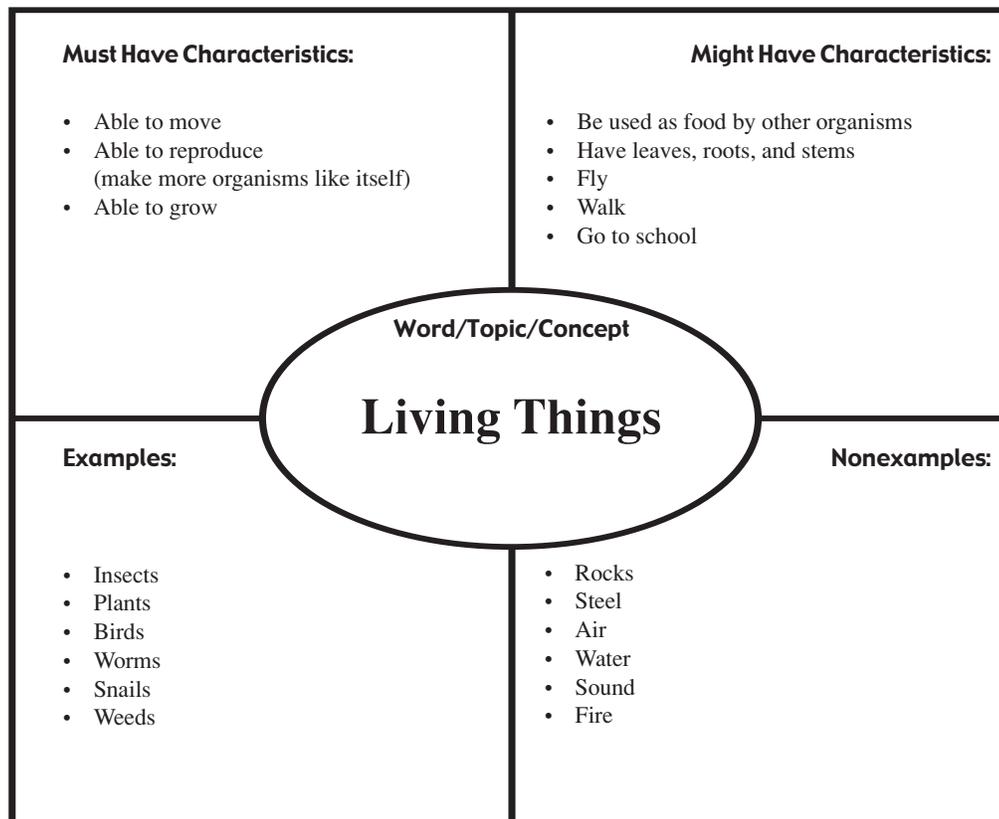
This activity can be done with the whole class working together or in groups if enough objects can be obtained (see materials list). Students could work in cooperative teams of 3 to 5 students.

1. Begin by showing the students the objects. Allow students a few minutes to share observations and information about the objects.
2. Invite a student to move the objects into two different groups (or have each team arrange their objects into two groups). Have class members see if they can guess why the objects were grouped the way that they were.
3. Allow a few more students to form groups with the objects. Hopefully someone will group them as living and nonliving. If not, suggest that someone try grouping them as living and nonliving.

4. Discuss with the class what all living things have in common. (They are able to grow, reproduce, and move.) Make sure students understand that just because an object moves, does not mean it is alive. Also, something may grow and not be alive. To be alive, an object must do all three.
5. Discuss the difference between nonliving and once-living. Ask the students which objects were once-living or were once a part of a living object, but are no longer alive. (wood, paper, apple, etc.) What is the difference between these objects and the nonliving objects such as the nail, rock, or aluminum can?
6. Give each team a set of the Word Cards and ask them to arrange them into three groups; living, once-living, and nonliving.
7. Discuss team responses. Give students an opportunity to explain why they grouped the cards they way they did.
8. Make an overhead, or chart, of the Vocabulary Sheet for “Living Things” or copy it onto the board. Also provide a copy for each student. Working with the students, fill in the sheet. Some possible responses are listed below:

Materials

- Various objects and organisms, such as the following:
- rocks
- empty aluminum can
- nails
- sand
- water
- zip-lock bag with air sealed inside
- seeds
- apple
- paper
- wooden objects
- potted plants
- live animals (insects, fish, hamster, dog, cat, etc.)



9. Provide copies of the vocabulary sheets for “Nonliving Things”, “Once-Living Things”, and “Organisms” to students. (Or, make larger copies that teams could fill out together.) Have students work with their team and fill out the vocabulary sheets.
10. Go over the vocabulary sheets with the class. Have student save the sheets in their journal so they can add to them as they gain more knowledge about living and nonliving things.

Possible Extensions/Adaptations

Take the class outside for a walk around the neighborhood. Challenge students to find living, nonliving and once-living things. Have students make lists and drawings of things they find to add to their journals.

Have students make a collage of living and nonliving things by folding a paper in half and writing “Living Things” at the top of one half and “Nonliving Things” at the top of the other half. Students will cut pictures from old magazines of living and nonliving things to glue onto the paper. Remind students that in a collage, pictures are overlapped and displayed in a creative way.

Assessment Suggestions

Have students divide a piece of paper into three columns and title each column with “Living”, “Nonliving”, or “Once-living”. Challenge the students to list as many things as they can for each category.

Additional Resources

<http://www.fi.edu/tfi/units/life/>

Homework & Family Connections

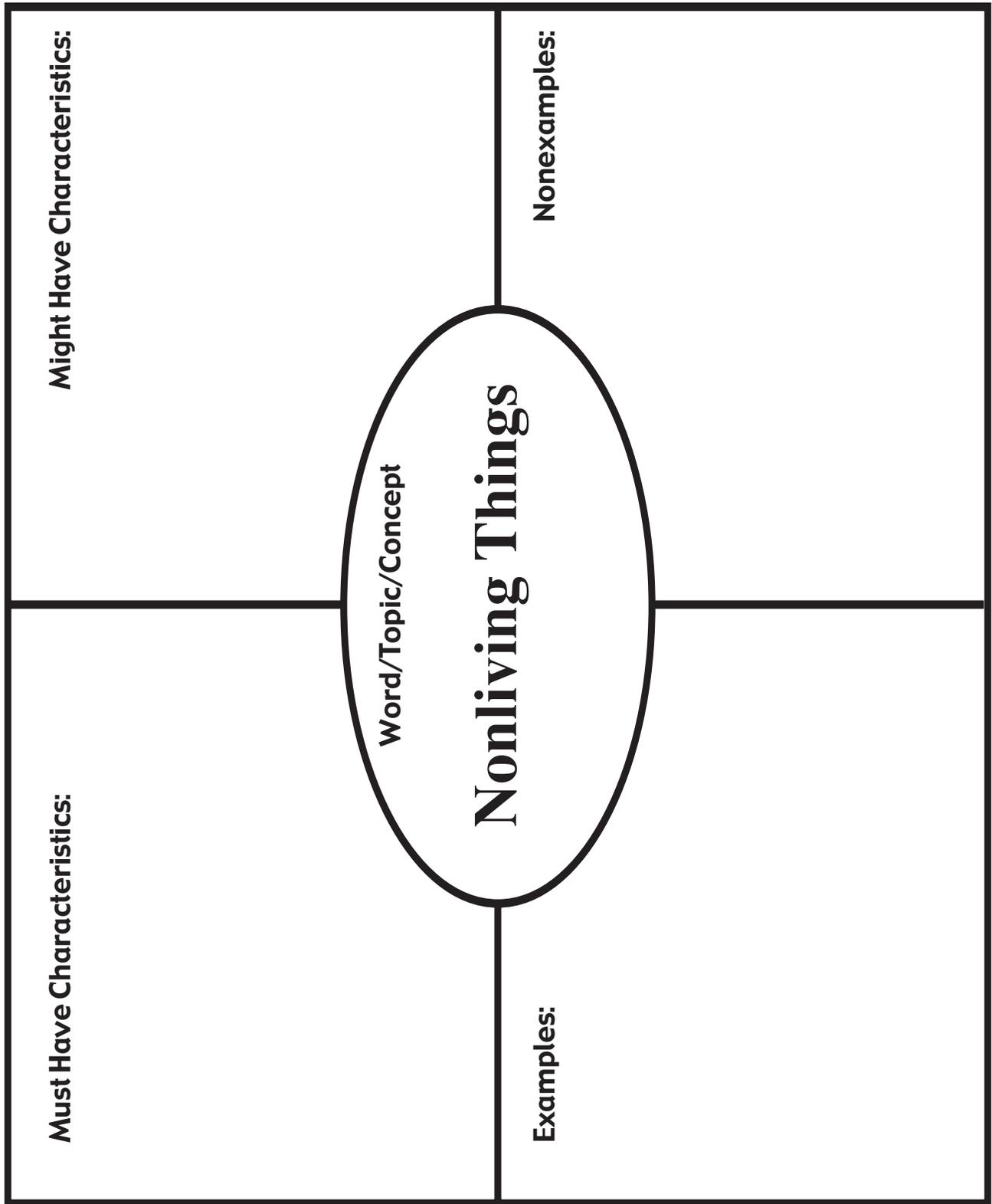
Ask students to look around their homes, yards, and neighborhoods and take notes on the living, once-living, and nonliving things they can find. Have students add their notes to their science journals and share what they learned with their teams.

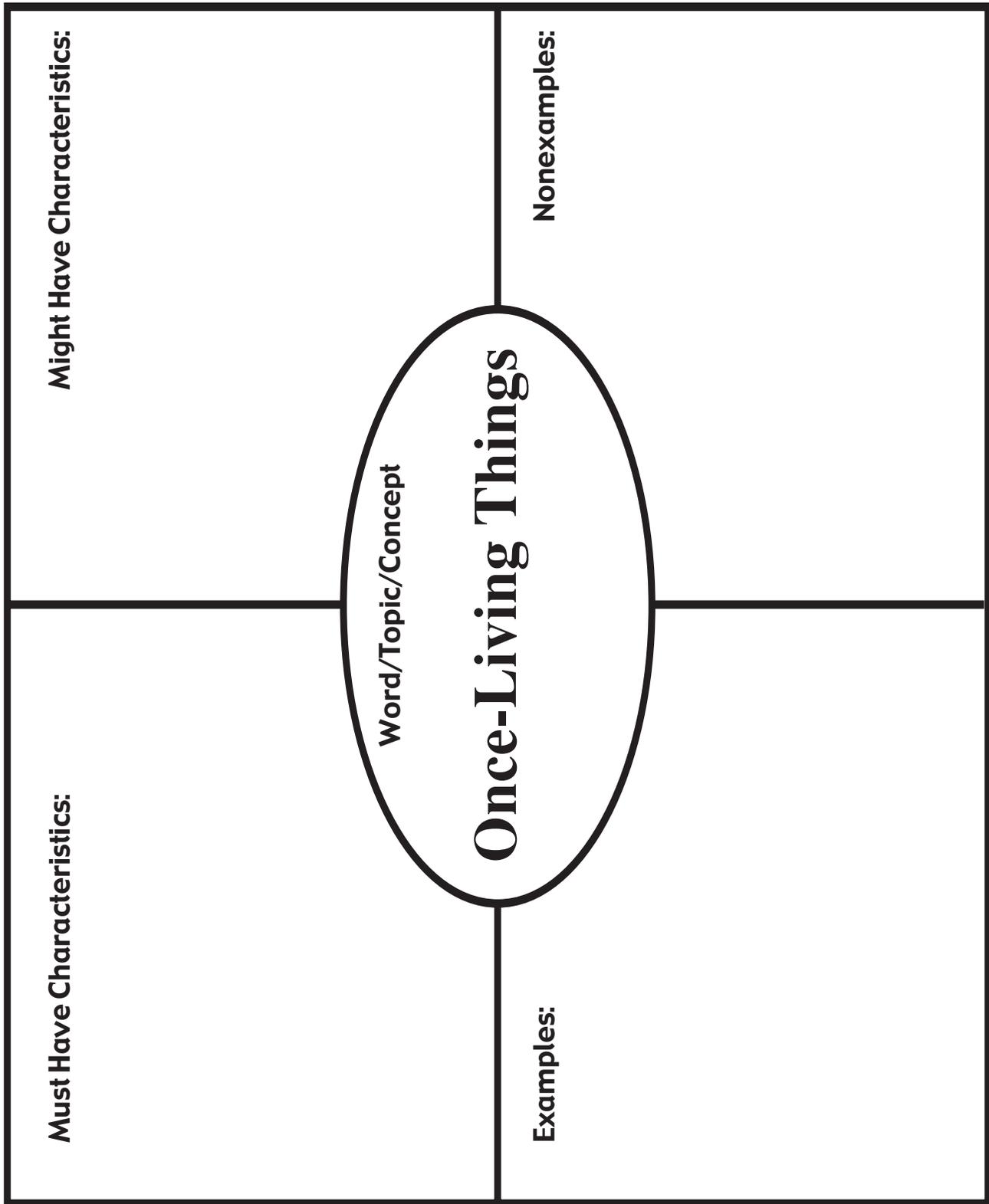
Word Cards

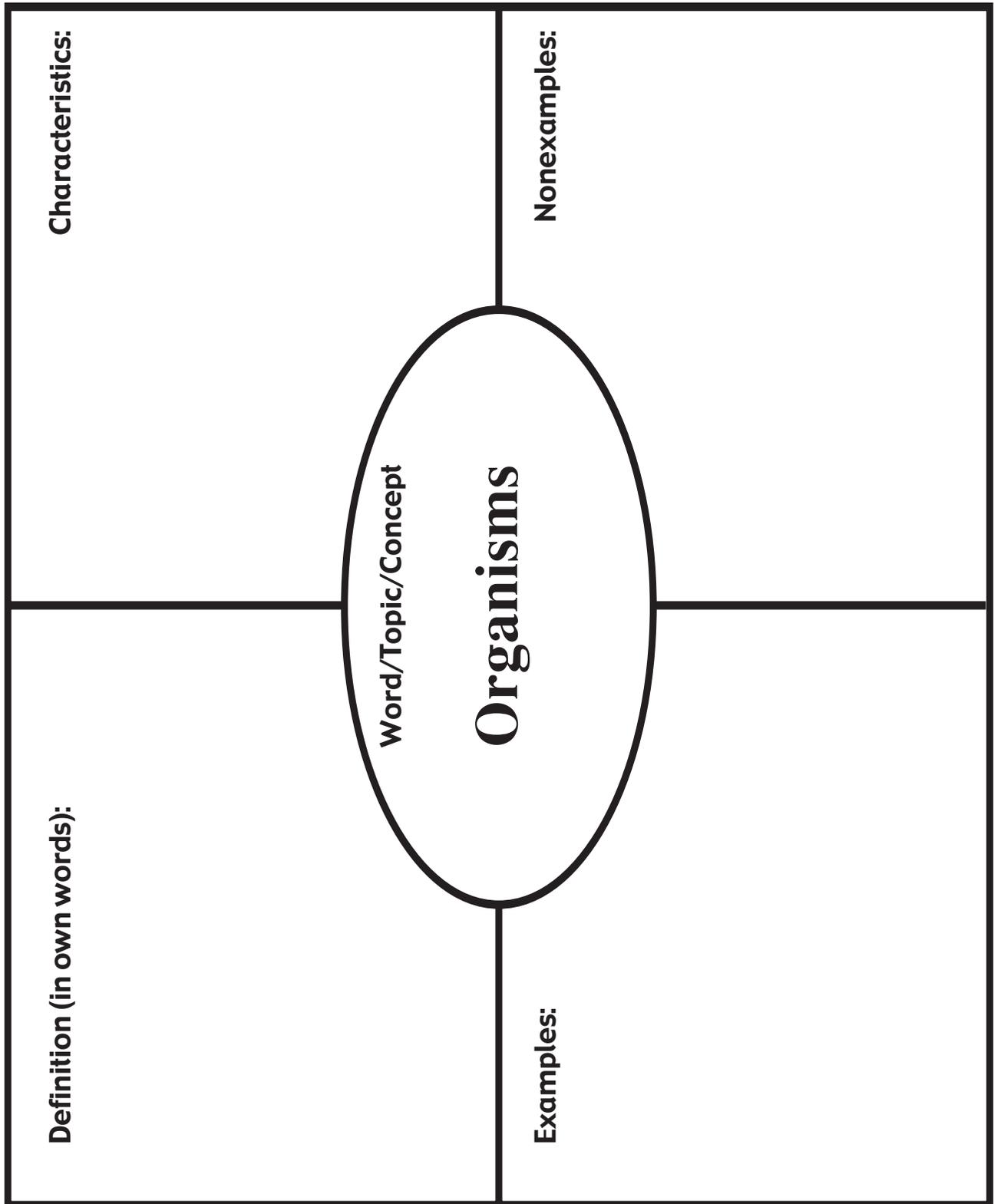
water	air	rocks
sunlight	heat	electricity
fire	sound	steel
butterfly	dog	apple tree
tiger	school teacher	grass
sea weed	crab	worm
elephant	flea	apple
tree branch	hot dog	bread
sugar	popcorn	hamburger
salt	clock	hair

Vocabulary Sheet

Might Have Characteristics:	Nonexamples:
Word/Topic/Concept	
Living Things	
Must Have Characteristics:	Examples:







Activity–Greenhouses

Standard II

Objective 2

Connections

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

Science

1. Use science process and thinking skills
3. Understand science concepts and principles
4. Communicate effectively using science language and reasoning

Math

5. Make mathematical connections
6. Represent mathematical situations

Teacher Background

The nonliving parts of an environment interact with the living parts. The main nonliving parts of an environment include sunlight, soil, air, water, and temperature. The nonliving things also interact with each other. For example, soil can be moved from place to place by air and water. We can observe nonliving parts interacting with the living parts of an environment. By changing the amount of light, temperature, or water, students will be able to discover the effects that nonliving elements have on the growth of a seed.

When planning this activity, you will need to decide what kinds of seeds to plant and where to display the finished greenhouses. Any type of seed will work, but larger seeds such as corn, beans, or peas are easier for students to handle and observe plant growth. If larger seeds are used, have the students plant 5 seeds. If smaller seeds are used, they could plant 10 seeds. Students will then be able to use a fraction to record how many of their total seeds grew. Greenhouses can be displayed in several different ways. Using strings and paper clips for hooks, they can be hung from the ceiling above the student’s desk, tacked to a bulletin board, or taped to a wall, cupboard doors, or windows.

Invitation to Learn

1. Provide each team of 3-5 students with a variety of seeds in a zip-lock bag. Students should use a hand lens and make notes and drawings of the seeds. Have students write what they think each seed is. For each type of seed, have students estimate how many seeds they think it would take, lined end-to-end, to make a

centimeter and an inch. Team members should share their observations with their teams. Allow teams to share with the class.

2. Have students discuss the question, “Are seeds living or nonliving?” Point out that seeds have the potential for life but to grow they need to have the right things provided by their environment. Have students suggest what nonliving things they think a seed needs before it will start to grow. List their responses on the board. They should include water, light, warm temperature, soil, and minerals. Explain that different types of plants need different amounts of these nonliving things. What kinds of plants need lots of water? What kinds need very little water? Do some plants grow better where it is very hot? Do some plants do better in colder places? Do all plants need the same amount of light?

Instructional Procedures

Tell the class that today they are going to set up a miniature greenhouse for some seeds. The greenhouses will provide all the things that seeds need to grow. Ask students to share what they know about greenhouses. Emphasize that greenhouses are specially controlled environments to help plants grow. In a greenhouse, all of the nonliving elements are provided and controlled so that the plants will grow very well.

1. Lay out the materials for the greenhouses and provide students with a Greenhouse Instruction Sheet. Tell them to carefully follow the directions on the sheet.
2. After students have completed their greenhouse, have each team work together and make one or two extra greenhouses. These extra greenhouses will be used to test what effect changing the nonliving elements will have on the seed’s growth. Teams should discuss what they want to do differently with their extra greenhouses, such as not adding as much water, adding a lot more water, putting the greenhouse in a dark closet or in a sunny window, putting the greenhouse in a cold place (outside) or a hot place (over the heater), etc. Students should also write down what they think will happen because of the changes they made to their extra greenhouses.
3. Each team should carefully label their extra greenhouses and set them up. Students should also label and display their personal greenhouses.

Materials

- A wide variety of flower and vegetable seeds in zip-lock bags for each team.
- One coconut (to show the class the worlds largest seed)
- Rulers

Materials

Per Student plus 2 extra for each team

- 1 sheet of dark construction paper “9 X 12”
- 1 pint sized zip-lock bag
- cotton balls
- seeds
- scissors

Per team of 3-5 students

- spray bottle of water
- stapler

4. Bring the class back together and have each team tell what they did with their extra greenhouse and how they think the changes will affect the seed's growth.
5. Tell the class that they will observe their personal and team greenhouses three times a week to make measurements and record growth and changes in the plants. Show the class the Greenhouse Observation Sheet and explain that they will use this sheet to carefully record their observations.
6. Allow students time during the week to make and record observations. Have students share their observations with their teams and the whole class. What differences do they notice between their personal plants and the team plants?
7. Discuss with the class the interactions they see between the living and nonliving things in their greenhouse environments. Have them look for these interactions in the environments around them.

Curriculum Integration

Math/Science—Students will record the number of seeds that sprouted by making a fraction. For example if 5 seeds are placed in the greenhouse and 3 started to grow the student would record $\frac{3}{5}$ of the seeds sprouted.

Students will also use measurement to record the growth of their seedlings over time.

Possible Extensions/Adaptations

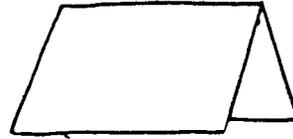
To extend this activity, have students transplant a few of their seedlings from their greenhouses into containers of potting soil and continue to make observations.

Homework & Family Connections

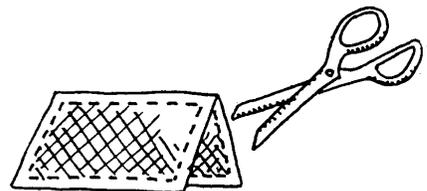
Send seeds or seedlings home with students and have them plant them in a garden, flowerbed, or a pot. Discuss with the students what they will need to do to help the plant grow and stay healthy. Have students report to their teams and the class how their plants are doing. If some of the student's plants die, ask students to try to explain what might have caused the plants to die.

Greenhouse Instruction Sheet

1. Fold paper in half, the short way.



2. Poke the scissors through both layers of the construction paper and cut out the middle section, leaving a 1 inch border. Write your name and team name on the border.



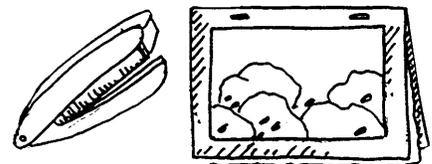
3. Fill the bottom part of the zip-lock bag with cotton balls and place the seeds between the cotton balls and the bag so they can be easily seen. Your teacher will tell you how many seeds to plant.



4. Spray about 10 squirts of water into the bag. Seal the bag.



5. Staple the bag into the frame. Your greenhouse is ready to be hung up. (Your teacher will tell you how to do this)



Greenhouse Observation Sheet

Name _____ Team _____

Type of seeds planted _____ Number of seeds planted _____

Team Greenhouse			Choose one plant in the greenhouse to observe. Be sure to use the same plant every time you make an observation.			
Date	Seeds Growing		Length of stem measured from the seed	Length of root measured from the seed	Number of leaves	Drawing of plant
	Number	Fraction				

Activity–Terrariums/Aquariums

Standard II

Objective 2

Connections

Standard II

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

Objective 2

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

Intended Learning Outcomes

Science

1. Use science process and thinking skills
4. Communicate effectively using science language and reasoning

Materials

- small creatures
- hand lens

Teacher Background

Your students will become excited and engaged as they observe and care for small creatures such as crickets, meal worms, pill bugs, earth worms, snails, fish, etc. Many of these fascinating creatures can be easily obtained and kept in the classroom. Information and suggestions for some of these creatures are provided on the Creature Information pages. Read through these sheets and choose a creature for your classroom.

Terrariums and aquariums can be made in many different ways using a wide variety of materials. See the Terrariums and Aquariums pages for ideas on using terrariums and aquariums with your class.

Invitation to Learn

This activity can be a brief observation of small organisms, or it could be expanded and developed in to a much longer discovery activity (see Teacher Background and Extension Activities).

Choose a small creature for your students to observe. One creature for each pair of students works well. The whole class could observe the same kind of creature or different creatures could be provided for each team. Some creatures, such as crickets, may need to be placed in a zip-lock bag or a clear plastic petri dish. If using a zip-lock bag, use a straw to inflate the bag and then seal it closed.

Have students use a hand lens to make close observations of their creatures. Students should use a ruler to make measurements and carefully record their observations using notes and drawings. Encourage students to write down what they think they know about their creature and what they would like to learn (see Creature Observations page). Ask students to think about what nonliving things and living things their creature will need in its environment to survive? List their ideas on the board and discuss ways of providing those needs for their creatures.

Instructional Procedures

1. Before beginning choose a method for making terrariums or aquariums (see Terrariums and Aquariums pages) and obtain materials.
2. Tell the class that they will be constructing an environment for the creatures they observed in the Invitation to Learn activity.
3. Teams of 3-5 should work together to make one terrarium or aquarium. Depending on what kind of creatures are available you may choose to have each team make a different type of environment or each team could make the same kind of environment.
4. Ask the class to suggest what kinds of things they will need to put in the environments so that their creature will be able to survive. Have them think about what kinds of things are in the creature's natural environment. You may want to take the class outside and look for places they think their creature might live. Students may also collect a few items such as sticks, rocks, plants, leaf litter, or soil to put in their environments.
5. Demonstrate methods you would like students to use in constructing their environments. You may want to consider having students work outside. This will make clean up much easier if dirt happens to get spilled. Otherwise, spread newspaper to protect student's work surfaces.
6. After the terrariums are planted have students water them using a spray bottle. Make sure the soil is damp, but not soggy or muddy. If the soil is too wet, leave the lid open for a day or two to let it dry out.
7. Place a few dry leaves or leaf litter in the terrarium along with small stones and a few small sticks.
8. Place the completed terrariums under grow lights or in a bright place in the room. Do not place the terrariums in direct sunlight as they may overheat and harm the plants.
9. In a few days, after the terrariums have stabilized, it's time to add the creatures. Before adding creatures, make sure all openings that may be used as escape routes are closed.
10. During the following weeks teams should make and record observations (see Terrarium and Aquarium Observations page). Allow teams to share their observations about the interactions between the living and nonliving things with the class. Discuss what is happening in the environments. If creatures are dying, try

Materials

- containers for terrariums
- soil
- plants
- seeds
- stones and sticks
- leaf litter
- spray bottles

to discover why. Are they not getting the right kind of food? Is it too wet? To dry?

11. Environments will need to be monitored and watered and provided with food. Additional creatures may be added to establish food chains such as grasshoppers and praying mantises.
12. At the conclusion of the activity, return any items that were collected to their natural environment and clean out the containers.

Curriculum Integration

Math/Science—Students will use measurement to learn the size of their small creatures.

Possible Extensions/Adaptations

Have students ask, “I wonder” questions, such as “I wonder if worms can crawl backwards?” or “I wonder if pill bugs like light or dark places?” Next, have them do activities or research to find out the answers to the questions.

Assessment Suggestions

Use student’s observation sheets to determine if they understand what is happening in their terrariums.

Additional Resources

<http://www.worldwildlife.org/>

Creature Observations

Name _____ Team _____

Creature Observed _____

Questions to think about as you observe your creature:

- What does it eat?
- How does it eat?
- How does it move?
- Where does it live?
- How does it reproduce?
- Is it harmful or helpful?

List the things you already know about your creature.

List the things you can learn by observing your creature.

What do you wonder about your creature?

What living things do you think the creature needs in its environment to stay alive?

What nonliving things do you think the creature needs in its environment to stay alive?

Draw your creature. Measure your creature and record its size.

Terrarium or Aquarium Observations

Date	Plants How many? How do they look?	Animals How many? Are there any baby animals?	Changes Was food or water added? Were more plants or animals added?	Drawings

Creature Information

EARTHWORMS:

To house a dozen or so earthworms for a few days, place them in a cottage cheese carton or similar container half filled with moist soil. A lid with small holes punched in it will keep the worms from escaping. Earthworms like cool temperatures. If kept in the refrigerator, they will live for several weeks. (Just be sure to label the container.)

A breeding colony can be maintained in a larger container, such as a plastic tub, an aquarium, or even a large bucket. Soil mixed with leaf litter, compost, peat, sawdust, or cow manure makes a good medium for worms. Water the soil to keep it moist, but do not over water. Place two or three dozen earthworms on the surface and they will burrow into the soil. Add a thin layer of leaf litter or shredded newspaper to help reduce moisture loss.

Small amounts of food should be added to the surface. Earthworms will consume almost any kind of organic debris. They can be fed shredded bits of grass, dried leaves, lettuce, and apple or potato peels. Keep the earthworms in the coolest place in the room.

LAND SNAILS:

Snails can be found in leaf litter, under rocks or logs, and in other damp locations. They can be kept in transparent plastic shoeboxes or aquariums arranged to simulate the natural environment. Containers will need to be covered to maintain the necessary humidity and to keep snails from escaping, but will also need some ventilation. Soil on the bottom of the container will help to maintain the humidity.

Captive snails will consume a variety of foods: lettuce, carrots, apples, or celery will meet their needs.

TERESTRIAL ISOPODS (pill bugs, potato bugs):

Land isopods live in dark moist places. They are easily collected by turning over rotting logs, boards, bricks, or rocks. To keep classroom isopods, put 3 cm of potting soil in a plastic sweater box, or terrarium. Provide a dark place by setting a piece of corrugated cardboard on a few pebbles. Add a few pieces of decaying bark or wood. Sprinkle the container with water, making sure the habitat is damp but not saturated.

Feed the isopods a slice of potato, carrot, lettuce, or ripe fruit. Remove food that begins to mold. Cover the habitat with a lid that allows ventilation. You should see young in three to four weeks.

MEALWORMS:

Mealworms can be purchased at pet stores and bait shops. They can be kept in a ventilated, non-cardboard container. Mealworms come with a supply of food but will need to be given additional food if they are going to be kept for a long time. Any dry cereal will work as food, either flakes, oatmeal, or bran. Your mealworms will also need a source of water. Water can be provided by placing a slice of apple, carrot, or potato in with the mealworms.

Mealworms spend most of their lives in the larval stage, typically six to eight months.

CRICKETS:

Crickets can be purchased from most pet stores. To keep crickets for a short time in the classroom, place 2 - 4 cm of soil or sand in a jar or other container with a ventilated lid. Add a crumpled paper towel for the crickets to climb on and to provide hiding places. Crickets will eat a variety of foods; a slice of apple, carrot, or potato are good short-term foods and will provide the crickets with the moisture they need. Food should be replaced every day or two so it will not decay or mold.

FOR MORE INFORMATION:

Classroom Creature Culture Algae to Anoles by Carol D. Hampton; David C. Kramer (NSTA Publications)

Animals in the Classroom by David C. Kramer (Addison-Wesley Publishing Company)

Terrarium Habitats by Kimi Hosoume with Jacqueline Barber (University of California)

The Practical Entomologist by Rick Imes (Simon & Schuster Inc.)

National Science Education Standards National Research Council (National Academy Press)

Terrariums and Aquariums

Terrariums

Containers

Terrariums can be made in many types of containers. Plastic peanut butter jars or similar clear plastic storage jars, clear plastic deli containers, or clear 2-3 liter pop bottles can all be used for small terrariums. Larger terrariums can be constructed in glass aquariums or plastic animal cages. To make it easy to set-up and maintain, containers should have a large removable lid. A screen or glass lid for a glass aquarium works well.

Soil

Any good potting soil can be used. Local soils may also be used. Collecting local soil for the terrarium can add a little extra in the form of seeds and creatures collected with the soil. A mixture of 1/2 potting soil and 1/2 local soil usually works well. In larger terrariums, it is helpful to add a layer of small gravel, such as aquarium gravel, to the bottom of the terrarium before adding the soil. The gravel will allow extra water to drain from the soil.

The size of the container will determine the amount of soil. Smaller containers should be filled with about 1/3 with soil. Larger containers should have 4-6 inches of soil added. Soil should be damp but not wet before adding it to the terrariums.

Plants

Many types of plants can be use in terrariums. The type of plants you choose will depend on what kind of light is available. If grow-lights are used, sun-loving plants such as grasses and alfalfa can be grown. If only ambient room light is available, shade loving plants will do better. Violets, strawberries and many kinds of houseplants will grow well in most room light.

Plants may either be started by planting seeds or transplanting already established plants. A good method is to collect some local plants, such as violets or strawberries, and transplanting them. This will give a quick start to the terrarium. Then plant some seeds that will begin to grow and may be used as a food source by creatures that are added. Students may want to collect some seeds from local weeds and other plants to sow in their terrariums. To plant seeds, scatter them on the surface of the soil and then cover the seeds with a thin layer of soil.

Water

The soil in the terrarium should be kept moist but not muddy. If the terrarium is not vented, very little water should need to be added. If a screen lid is used, regular watering will need to be done. Watering the terrarium with a spray bottle is easy and will leave water drops on the leaves of plants that can be used by any creatures that call the terrarium home.

Other

Adding small stones and sticks can add interest to terrariums and will give creatures a place to hid and climb. Allow students to collect items to place in their terrariums. Leaf litter is also good to have in the terrarium. Many creatures, such as pill bugs, worms, and snails, will hide in the litter. Students will be able to observe the litter decompose as it is eaten by these small creatures.

Aquariums

Aquariums can also be large or small and can be used to provide a home for many interesting creatures.

Pond

If you are close to a pond, or other natural, wet environment, it is simple to collect enough water and organisms to set up a pond aquarium in the classroom. About a gallon of water is sufficient. Be sure to get some of the mud off the bottom and some of the local aquatic plants and algae. If possible, collect water snails, minnows or other creatures for your aquarium. Additional water may be needed as water in the aquarium evaporates. Untreated well or spring water can be added directly to the aquarium. If tap water is being used, let it sit for 24 hours to allow the chlorine to dissipate before adding it to the aquarium.

Activity–Plot Studies

Standard II

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

Objective 2

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

Intended Learning Outcomes
Science

1. Use science process and thinking skills
2. Manifest scientific attitudes and interests
4. Communicate effectively using science language and reasoning

Math

4. Communicate mathematically
5. Make mathematical connections
6. Represent mathematical situations

**Standard
II**
**Objective
2**
Connections

Teacher Background

In this activity, students will closely examine a small area of the school ground (or other local environment) in order to discover what kinds of plants and animals live there. Students should be encouraged to look for ways in which the nonliving elements in the environment (sunlight, soil, air, water, and temperature) provide the living organisms with food, water, space, and shelter.

Safety Concerns

Most small critters that will be encountered around your school are harmless, but before taking students outside, be sure they understand that they should not touch bees or wasps or other bugs of which they are unsure.

Invitation to Learn

Suggest to the class that sometimes we don't look very closely at the environments around us. Because of our inattention, we may miss many of the interesting things going on around us. Suggest that there may be things in the classroom that no one has noticed. Often these things go unnoticed because they are small or in an out-of-the-way place. Sometimes we don't notice things because they have always been there and we simply don't pay any attention to them.

Tell the class they are going to practice their observation skills by examining a section of the classroom closely and taking notes on what

they find. To do this, they will need to change their perspective. Ask if students have seen the movies “A Bug’s Life” or “Honey I Shrunk the Kids”. In those movies, the world was shown from the perspective of someone very small. Discuss with the class how that perspective was different from their perspective of the world. Encourage the students to try to get down to the level of a bug and look at the environment as the bug would.

Divide the classroom into sections and assign each team of 3-5 students a section to explore. You may wish to set some limits or ground rules such as:

- Everyone must stay on the ground.
- Certain designated areas, (closets, cupboards, etc.) are off limits.
- Don’t disturb other students’ personal items.

Provide students with hand lens and a notebook or clipboard. Tell them to use drawings and written notes to record what they find.

After the teams have explored, allow them to share with the class what they discovered. Tell the class that these kinds of observations are similar to what a type of scientist called a naturalist does. Discuss the work of Jane Goodall or other naturalists.

Instructional Procedures

Materials

For each team of 2-3 students

- Plot Study Journal Pages
 - hand lens
 - thermometer
 - meter stick or tape measure
- 4 golf tees
- clipboard
- 4 meter length of string

1. Choose an area close to the school for your class to study. An area that is out of the way such as a side or front lawn area where students do not play will work best. Flower beds, shrubs, and/or trees will provide more variation for your class to explore. Fields, parks, or churches close to the school may also work as a study area.
2. Divide the class into teams of 2 or 3. Explain that each team will be doing a thorough study of a small section of a local environment. They will classify everything they find in their area as living or nonliving and record what they see on Plot Study Journal Pages. Observations may be recorded using both words and drawings. It will probably be necessary to have students estimate the numbers of some plants and animals they find in their area. Work with students on sampling techniques, such as counting numbers in a smaller area and then multiplying by the number of smaller areas in the larger area.
3. Give each team a copy of the Plot Study Journal Pages, Plot Map, a hand lens, a thermometer, meter stick or tape measure, 4 golf tees, a clipboard, and a 4-meter length of string.

4. Once outside each team of students should find a place to lay out their study plot. They will do this by measuring off 1 square meter, marking the corners with a golf tee, and wrapping the string around the tees to enclose their plot. Encourage students to try to find an area that is not all lawn, such as under a bush or tree, a place where there are a few rocks or sticks, a flower bed, along a fence where the grass is longer, etc.
5. Explain that scientists often study the environment by making observations and carefully recording what they see. If students do not know the name of a particular plant or animal have them write a description (for example: fuzzy-leaf plant, or long bug with lots of legs).
6. Set a few rules that should be followed during the activity. They may include:
 - Do not disturb the study area.
 - It is OK to carefully turn over rocks, leaves, or sticks.
 - Do not dig or uproot plants.
 - Use the hand lens to make close observations of small items.
 - Record the temperature of the air and the soil.
 - Don't step into the study area.
7. You may want to give students a time period of at least 15 minutes that they must observe their areas. Often students will search their area over quickly and feel they have seen everything there is to see. Encourage them to just sit and watch for a while, to get close and systematically search the whole area.
8. Teams should work together to complete their Plot Study Journal Page and Plot Map.
9. After students have finished their observations have pairs display their Plot Study Journal Pages and discuss and compare what they learned. The following questions may be helpful:
 - What did you observe about the soil in your plot? Do you think it is good for plants? Why?
 - Where do you think the plants and animals in your plot get water? Is there a source of water they can rely on? What do you think would happen to the plants and animals in your plot if they didn't get water for a day?...a week?...a month?
 - What evidence of water do you actually see in your plot? Where does it come from? Would you classify your plot as very dry, dry, wet, or very wet? Why?

- Think about the things that every living thing needs from its habitat, such as food, water, air, shelter, space. Does your plot have everything in it that is needed by everything that lives there? If not, how do the things living there get their needs met?
- If your plot is in an area that is cared for (mowed, watered, pruned, etc.) how might it be different if it were allowed to grow wild and not cared for? If it is in a wild area, how might it be different if someone cared for it like a garden?
- Use the coordinate points on your Plot Map and tell me what you found at (B,3), (A,2), etc.

Curriculum Integration

Math/Science—In this activity, students use coordinate points to record and communicate the locations of things found in their study plot. Encourage students to use the coordinate points when discussing the location of things in their plot. Discuss with students other places, such as maps, where coordinate points are used to find locations.

Possible Extensions/Adaptations

If your study area is in a location that will not be disturbed, leave the golf tees in place and return and observe changes in the plots. Make copies of the teams original Plot Maps so students can make comparisons each time they visit their plots. To help students locate their plots, have them draw a map of its location. They could use identifying features, such as a tree, and then count paces in a certain direction and record it on a their maps.

If students have made terrariums, allow them to collect a few plants or animals from their plots to put in their terrariums. Have students consider whether the plant's and animal's needs will be met in their terrariums before they take them. After a few weeks, any specimens could be returned to the study plots.

Assessment Suggestions

Ask students to pick one organism that they found in their study plot and list the things it needs to survive. Have them explain how the organism gets the things it needs from the environment where it lives.

Additional Resources

<http://www.nwf.org/education/>
<http://www.units.muohio.edu/dragonfly/index.shtml>

Home & Family Connections

Students may wish to observe a plot at home. Provide them with strings, golf tees, and journal pages to use at home. Encourage students to ask family members to help them learn the names of the organisms they find in their plots. Have students compare their home plots to their school plots and share with the class any interesting organisms or nonliving things they find.

Plot Study Journal Page

Observers' Names: _____

Nonliving Things

Air Temperature

_____ degrees F

Soil Temperature

_____ degrees F

(Make a small hole and place the bulb end of the thermometer into the hole and cover it with soil. Wait 2 minutes and record the temperature.)

Light (circle one)

Full Sun Part Sun Full Shade

Dirt

Draw a close-up view of the dirt.

Other Nonliving Things

Draw and describe.

Living Things

Draw and Describe

Plants

Animals

Once Living Things

Plot Study Journal Page

Plot Map



Draw a map of your plot on this grid. Make drawings and write the names of the living and nonliving things in your plot. Place the drawings and names on the grid in the same places as they are on the plot. Make sure to point the N arrow to the North before you start.

5					
4					
3					
2					
1					
	A	B	C	D	E

Science
Standard III
Activities

Activity—Zoom Ball

Standard III

Students will understand the relationship between an applied force and the resulting motion of an object.

Objective 1

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

Intended Learning Outcomes

1. Use Science Process and thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Standard III

Objective 2

Connections

Background Information

Objects at rest will remain at rest unless acted upon by a force. A force is a push or a pull. Objects in motion will remain in motion unless acted upon by a force (push or pull).

The washers are at rest on top of the table or countertop. When the paper is quickly pulled out from underneath them, they try to stay put. When you pull the cords outward, the zoom ball goes flying. The pushing action of the cords, against the opening of the bottle, sets it in motion. When the zoom ball reaches the other end of the cords, an opposite pushing action (your friend's pulling motion) stops the ball for a moment and then sends it flying in the reverse direction.

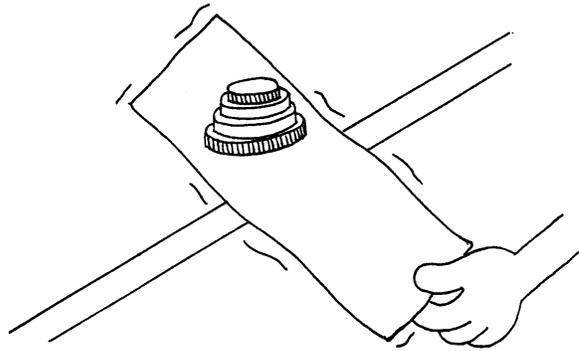
Invitation to Learn

Peaceful Washers

1. Place the paper on the edge of a table or countertop with most of the paper off the surface.
2. Stack the washers on top of the paper.
3. Hold onto the loose edge of the paper and quickly pull down on the paper.
4. Observe what happens to the stack of washers.

Materials

- 5 washers
- 4 1/4" X 5 1/2" piece of paper



What's Happening?

If you pulled quickly enough, the stack of washers will stay stacked on the table. The coins are at rest on top of the table or countertop. When the paper is quickly pulled out from underneath them, they try to stay put.

Riddle and Charades

1. Share the following riddle:

“I am two words. Both words describe ways to get a wagon up a hill. Each word has four letters. The first two letters of both words spell the word ‘up’ backwards. The last two letters of one of the words reminds you to be quiet. The last two letters of the other word are ‘twins’. Which two words am I?”

(Science Horizon, Grade 3, Silver Burdett & Finn, 1991)

Give the students time to analyze the riddle and come up with the answer “PUSH and PULL.”

2. Brainstorm with the students daily activities at school, at home, and at play that require a push and/or pull.
3. Define “force” as a push or a pull.
4. Play the game of Charades. Students take turns acting out an activity that involves some kind of a force—either a push or a pull. The rest of the class guesses what action was portrayed and then tells whether the force used was a push or a pull.
5. After each dramatization, use the action portrayed as new words for the song, “Here We Go Round the Mulberry Bush.” Each time the students come to the last phrase in the song, end with the words “with a push or a pull in the morning.” For example: “This is the way we put up the flag, put up the flag, put up the flag. This is the way we put up the flag, with a push or a pull in the morning.”

Materials

- ❑ Music for “Here We Go Round the Mulberry Bush”

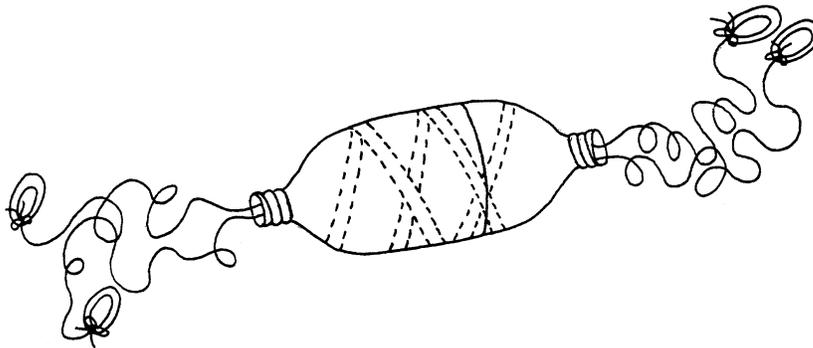
Instructional Procedures

Preparation

1. Cut the bottoms off of the soda bottles.
2. Push the bottles together, end to end, so they form a football shape.
3. Decorated if desired.
4. Thread the two cords through the necks.
5. Cut the six-pack holder rings apart to form four two-loop handles.
6. Tie a set of handles to the end of each cord.

Activity

1. Divide the students into pairs. Give each pair a Zoom Ball. Each player holds onto two handles and moves away from the other player until the strings are tight. Slide the zoom ball to one end. If you are the player closest to the zoom ball, pull your hands apart to send the zoom ball to your friend. To receive the zoom ball, keep your hands together.
2. Observe what happens to the zoom ball.
3. Discuss your observations.



What's Happening?

When you pull the strings outward, the zoom ball goes flying. The pushing action of the strings, against the opening of the bottle, sets it in motion. When the zoom ball reaches the other end of the string, an opposite pushing action (your friend's pulling motion) stops the ball for a moment and then sends it flying in the reverse direction.

Materials

- 2 - 1 liter plastic soda bottle (per student)
- 2 - plastic six-pack soda can holder (per student)
- 2 - 8 foot lengths of cord (per student)
- decorating materials (if desired)
- scissors or box cutters

Curriculum Integration

Math/Science—Objective 1: Identify relationships among whole numbers.

1. Compare the relationship (“<”, “>” and “=”) between the number of successful passes of the zoom ball between the same partners on two attempts.
2. Compare the relationship (“<”, “>” and “=”) between the number of successful passes of the zoom ball between two different sets of partners with one attempt per set.

Possible Extensions/Adaptations

Extension

PE: Partner Push and Pull

Divide the students into partners. Assign one student in each group as “push” and the other “pull.” Have the students spread out. The teacher will name an exercise. Students will be given 30 seconds to determine if the exercise requires a push, a pull, or both forces. After 30 seconds, the student that represents that force will demonstrate the exercise. If it is an exercise that requires both a push and a pull, both students will participate. (Possible exercises: push-up, curl-up, wheelbarrow, frog leap, jumping jack, wind mill, arm circles, toe touches, etc.)

Adaptation

Zoom balls can also be made from smaller bottles.

Assessment Suggestion

In their journals, have the students label a page: “A force can be a push, a pull, or both.” Then, instruct the students to illustrate and label the different kinds of forces being used:

1. A pulling force
2. A pushing force
3. A pushing and a pulling force

Additional Resources

Books

Push and Pull, by Patricia J. Murphy (Scholastic Library Publishing)
Pushing and Pulling (Science For Fun), by Gary Gibson (Copper Beach Books)

Laser Discs

Windows on Science, Primary Vol. 3, Force and Motion Lessons 1-3, 5
Windows on Science, Primary Vol. 3, Work and Machines Lesson 1

Websites

<http://www.enc.org/weblinks/science/0,1578,1%2DForces,00shtm>
<http://www.enc.org/weblinks/science/0,1578,1%2DMotion,00shtm>

Homework & Family Connections

Finding Forces (worksheet)

Have the students observe and list ten different activities performed by various family members in the first column. In the second column, students classify the force used as a push and/or pull.

Materials

- Worksheet: Finding Forces (one per student)

Finding Forces

Identify ten different activities performed by family members in the first column. In the second column, classify the force used as a push, a pull, or both.

Activity	Force Used
Example: <div style="text-align: center; margin-top: 5px;">Opening the drapes</div>	Pulling
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Activity—Weighty Mistakes

Standard III

Students will understand the relationship between an applied force and the resulting motion of an object.

Objective 1

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

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Standard III

Objective 1

Connections

Background Information

Simple machines make work easier for us. In most cases, they allow us to do use less force over a greater distance. The formula is Work = Force X Distance ($W = F \times D$)

DEMONSTRATE this principle with several multiplication problems.

Work Force Distance

$$24 = 4 \times 6$$

$$24 = 3 \times 8$$

$$24 = 2 \times 12$$

As the force is decreased, the distance has to increase in order for the same amount of work to be done.

Weighty Mistakes is an example of a first-class lever where the fulcrum (corner molding) is between the force (cup with the paperclips) and the load (the cup with the eraser). Other examples of a first class lever are scissors and a crow bar. A first-class lever changes the direction of a force; one end of the lever moves up when the other is pushed down. Less force is used when the effort arm (the distance from the fulcrum to the point where you apply the force) is longer than the load arm (the distance from the fulcrum to the load). The closer the fulcrum is to the load, the less force is required to lift the load. In a second class lever, the load is between the force and the fulcrum (examples: wheelbarrow, nutcracker). In a third class lever, the force is between the load and the fulcrum (examples: fishing pole, broom).

Invitation to Learn

Materials

- Transparency for Simple Machines Song
- Music for Yankee Doodle

1. Define “work.” Explain that in science, work is being done only when a push or a pull is moving something over a distance. If an object doesn’t move when it is pushed or pulled, no work has been done.
2. Have students demonstrate work being done and not being done. Example: A student can pull her pencil box out of her desk – work has been done. Another student pushes against a brick wall. It doesn’t move, therefore, no work has been done.
3. Relate these principles to the Zoom Ball activity.
4. Explain that simple machines make work easier for us. In most cases, they allow us to use less force over a greater distance.
5. Introduce and sing the chorus to the Simple Machines Song.

Instructional Procedures

Preparation

Glue a plastic bathroom cup at the 1" mark and another at the 11" mark on the ruler.

Activity

1. Divide the students into cooperative learning groups of 2-4 students per group.
2. Give each student or group a data recording chart.
3. Place the eraser in the cup at 11". Place the fulcrum under the 6" mark on the ruler. Begin to place paper clips into the cup at 1", one at a time, until the eraser is lifted off the table or desk. Record the results.
4. Repeat step one, but place the fulcrum under the 8" mark on the ruler. Record the results.
5. Repeat step one, but place the fulcrum under the 4" mark on the ruler. Record the results.
6. Predict the number of paper clips required to lift the eraser if the fulcrum were placed under the 7" mark on the ruler. Record your prediction. Actually try it and record your results.
7. Predict the number of paper clips required to lift the eraser if the fulcrum were placed under the 5" mark on the ruler. Record your prediction. Actually try it and record your results.
8. Analyze the results of the experiment.

Materials

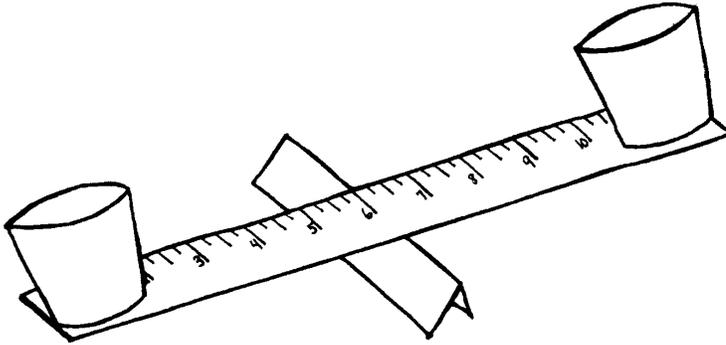
Per pair of students

- 1 Ruler
- 2 bathroom cups
- 1 box of large paper clips
- 1 pink pearl eraser
- 1 1/2" X 4" corner molding – fulcrum

One per student

- data recording chart

9. Explain and show examples of the three different classes (types) of levers.
10. Sing the lever verse, followed by the chorus, of the Simple Machines Song.



What's Happening?

This experiment is an example of a first-class lever where the fulcrum (corner molding) is between the force (cup with the paperclips) and the load (cup with the eraser). A first-class lever changes the direction of a force; one end of the lever moves up when the other is pushed down. Less force is used when the effort arm (the distance from the fulcrum to the point where you apply the force) is longer than the load arm (the distance from the fulcrum to the load). The closer the fulcrum is to the load, the less force is required to lift it.

Curriculum Integration

Math/Science

Objective 1:4 Model and illustrate meanings of the four operations (addition, subtraction, multiplication, division) and how they relate to each other.

1. Have the students come up with sets of multiplication problems that have the same product but different factors. This illustrates the principle that the same amount of work can be done by using less force over a greater distance.

Objective 5.1 Collect, organize, and display data to make predictions.

1. Graph the results of the experiment

Possible Extensions/Adaptations

Extension: Do an experiment similar to Weighty Mistakes, but use a plank for the lever bar, a larger fulcrum, a book for the load, and a spring scale to measure the force.

Adaptation: Group the students together so they can be a resource for each other.

Assessment Suggestion

Have the students draw a cartoon illustrating first-class levers being used efficiently OR inefficiently. The character involved must have the correct facial expression for the choice selected.

Additional Resources

Books

How Do You Lift a Lion? by Robert E. Wells (Albert Whitman and Company)

The Way Things Work by David Macaulay (Dorling Kindersley)

Simple Machines by Deborah Hodge (Ontario Science Center)

Machines – Spectacular Science Projects by Janice Van Cleave (John Wiley and Sons, Inc.)

Physics lab in the Hardware Store by Bob Friedhoffer (Franklin Watts)

Playground Physics - Simple Machines by Bob DeWeese (Evan-Moor)

Science Experiments With Simple Machines by Sally Nanivell-Aston (Franklin Watts)

Videos

Science Alliance # 3, Machines

Laser Discs

Windows on Science, Primary Vol. 3, Work and Machines Lessons 2 - 10

Websites

- <http://www.fi.edu/qu97/spotlight3/spotlight3.html>
- <http://www.ed.uri.edu/SMART96/ELEMSC/SMARTmachines/machine.html>
- <http://www.stemnet.nf.ca/CITE/machinessimple.htm>
- <http://www.mikids.com/Smachines.htm>
- <http://www.mos.org/sln/Leonardo/InventorsToolbox.html>
- <http://www.san-marino.k12.ca.us/~summer1/machines/simplmachines.html>
- <http://www.northcanton.sparcc.org/~greentown/simpmach.htm>

Homework & Family Connections

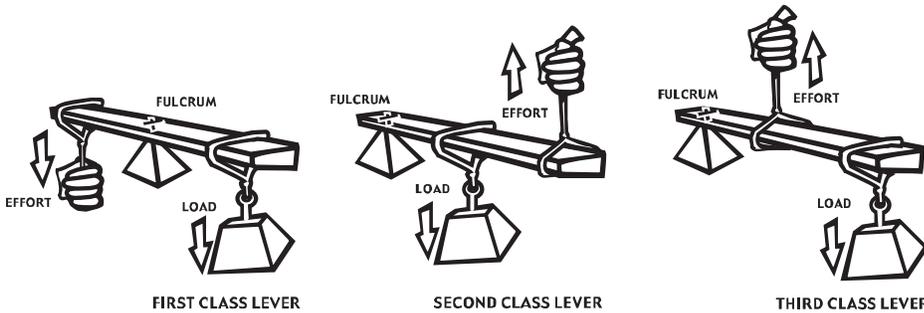
Locating Levers (worksheet)

Identify five different examples of levers found in your home. Draw a picture of each and label the load, the fulcrum, and the force. Classify each of the levers.

Materials

- Worksheet: Locating Levers (one per student)

Types of Levers



When the fulcrum is between the load and the effort, the lever is called a **first-class lever**.

When the fulcrum is at one end and the load is between the fulcrum and the effort, the lever is a **second-class lever**.

When the fulcrum is at one end and the effort is between the load and the fulcrum, the lever is a **third-class lever**.

Simple Machines Song

Tune: Yankee Doodle

Words: Vickie Ahlstrom and Kolette McClurg

When it's moved by force we call it work, but here's what I've been told:
Use any simple machine to help and ease that heavy load.

CHORUS:

Wheel and axle, pulley, wedge
Screw, inclined plane, lever
When you learn to use simple machines
You'll show you are so clever.

Our levers come three different ways, depending on the fulcrum.
You can lift, squeeze, cut, pull, haul, or toss to get all of that work done.

CHORUS

The inclined plane is like a ramp, a ladder, stairs, or hill.
Your muscles help to lift a load – you can if you just will.

CHORUS

The wedge is used to separate – for chopping, cutting, slicing.
You use a wedge to cut your cake, and don't forget the icing.

CHORUS

The screw just turns to do its job – like opening your juice.
Or use the screw to hold things tight, so that they won't get loose.

CHORUS

The wheel and axle turns around to help you get things going.
Uphill, downhill, or straight ahead, your smartness will be showing.

CHORUS

The pulley uses cord or ropes or even string or chains.
You can reach the highest places if you just will use your brain.

CHORUS

Name: _____

Data Recording Chart

LOAD (eraser)	FORCE POSITION	FULCRUM	FORCE (# of paper clips)
11"	1"	6"	
11"	1"	8"	
11"	1"	4"	
11"	1"	7"	Prediction: Actual:
11"	1"	5"	Prediction: Actual:

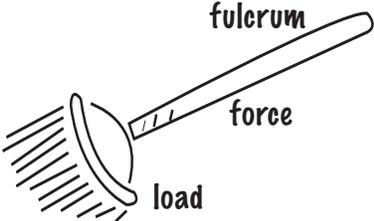
Name: _____

Data Recording Chart

LOAD (eraser)	FORCE POSITION	FULCRUM	FORCE (# of paper clips)
11"	1"	6"	
11"	1"	8"	
11"	1"	4"	
11"	1"	7"	Prediction: Actual:
11"	1"	5"	Prediction: Actual:

Locating Levers

Identify five different examples of levers found in your home. Draw a picture of each and label the load, the fulcrum, and the force. Classify each of the levers. See the example below:

Item	Picture	Type of Lever
Example: <p style="text-align: center;">broom</p>	 <p style="text-align: center;">third-class lever</p>	

Activity—Rolling Along

Standard III

Students will understand the relationship between an applied force and the resulting motion of an object.

Objective 1

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

Intended Learning Outcomes

1. Use Science Process and thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Standard III

Objective 2

Connections

Background Information

When things rub together, it causes heat and makes them slow down. Without wheels, your vehicle cannot move or moves very little. There's too much rubbing between it and the ground. Wheels reduce the amount of rubbing. You can move a heavy object using less force, by putting a wheel and axle under them.

Invitation to Learn

Have the students rub their hands together quickly. Ask them, "What did you observe happening?" Tell them that when things rub together, it causes heat and makes them slow down.

Instructional Procedures

Prior to the activity

Have the students make a vehicle body at home or at school.

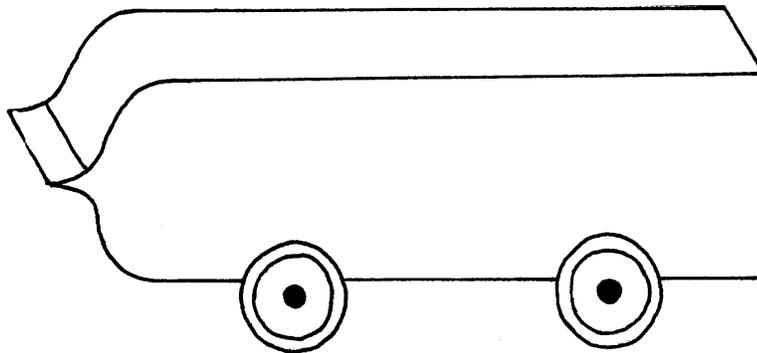
Activity

1. Instruct the students to push their vehicle body without wheels along the table or smooth counter top. Observe and record the distance traveled.
2. Arrange for parent volunteers to attach the wheel and axle units to the vehicles.
 - Cut 2 pieces of the large diameter straw the length of the width of the vehicle body.
 - Glue them onto the bottom of the vehicles.

Materials

- Homework assignment sheet for Wheels and Axles (one per student)
- Vehicle body (made at home or provide materials at school)
- 4 wooden wheels (per student)
- 2 straws (one smaller than the other one in diameter) (per student)
- Hot glue gun
- Glue sticks

- Cut 2 pieces of the smaller diameter straw 1” longer than the width of the vehicle body.
 - Slide the smaller diameter straws through each larger diameter straw.
 - Glue a wheel on each end of the smaller diameter straws and allow to dry.
3. Once the wheels have been attached, instruct the students to push their vehicle with wheels along the table or smooth counter top with the same amount of force used when the vehicle had no wheels. Observe and record the distance traveled.
 4. Discuss the results of the experiment and how the wheels reduced the amount of rubbing. Relate this to principle to everyday life.
 5. Sing the wheels verse, followed by the chorus, of the Simple Machines Song.



What's Happening?

Without wheels, your car can't move or moves very little. There's too much friction (rubbing) between it and the ground. Wheels reduce the amount of friction. You can move a heavy object, using less force, by putting a wheel and axle under it.

Curriculum Integration

Math/Science

Objective 4: Use appropriate techniques and tools to determine measurement.

1. Measure and record the distance the vehicle traveled with and without wheels.

Possible Extensions/Adaptations

Extension: Have the students pretend that they are the cavemen who invented the wheel. Instruct them to make a cave drawing advertisement trying to sell the advantage of their new invention to other cavemen.

Adaptation: If you teach in an area with little parental support, you may want to make the vehicle bodies in class with materials that you provide.

Assessment Suggestion

Have the students explain (written or orally) why the vehicle with wheels travel farther than the vehicle without wheels.

Possible Resources

Books:

How Do You Lift a Lion? by Robert E. Wells (Albert Whitman and Company)

The Way Things Work by David Macaulay (Dorling Kindersley)

Simple Machines by Deborah Hodge (Ontario Science Center)

Machines – Spectacular Science Projects by Janice Van Cleave (John Wiley and Sons, Inc.)

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Videos

Science Alliance #3, Machines

Laser Discs

Windows on Science, Primary Vol. 3, Work and Machines Lessons 2-10

Websites

<http://www.fi.edu/qu97/spotlight3/spotlight3.html>

<http://www.ed.uri.edu/SMART96/ELEMSC/SMARTmachines/machine.html>

<http://www.stemnet.nf.ca/CITE/machinessimple.htm>

<http://www.mikids.com/Smachines.htm>

<http://www.mos.org/sln/Leonardo/InventorsToolbox.html>

<http://www.san-marino.k12.ca.us/~summer1/machines/simplmachines.html>

<http://www.northcanton.sparcc.org/~greentown/simpmach.htm>

Homework & Family Connections

Rolling Along (worksheet)

Have the students identify and illustrate six objects in their home, garage, carport, and/or shed that have wheels.

Homework Assignment for Wheels and Axles

Our class is studying force and motion in science. We have learned that simple machines help us to do more work with less force. Next _____, _____, we will be experimenting with wheels and axles. Please help your student make a vehicle body to bring to school that day. You may use the milk cartoons provided or use your own building materials. The bottom of the vehicles can not be wider than 6 inches.

I need three to four parents who are willing to hot glue the wheels and axles onto the vehicles between _____ a.m./p.m. _____ a.m./p.m. I would like to meet with these volunteers and show them what to do and give them the equipment needed at _____ a.m./p.m. You may either stay at school or take the vehicles home to complete the task. I have two hot glue guns that can be used, so it would be helpful if at least two of the volunteers also had hot glue guns that could be used.

Please write in your child's planner if you are able to help with this project. THANKS!

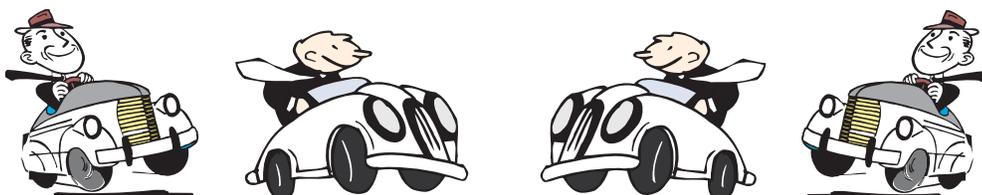


Homework Assignment for Wheels and Axles

Our class is studying force and motion in science. We have learned that simple machines help us to do more work with less force. Next _____, _____, we will be experimenting with wheels and axles. Please help your student make a vehicle body to bring to school that day. You may use the milk cartoons provided or use your own building materials. The bottom of the vehicles can not be wider than 6 inches.

I need three to four parents who are willing to hot glue the wheels and axles onto the vehicles between _____ a.m./p.m. _____ a.m./p.m. I would like to meet with these volunteers and show them what to do and give them the equipment needed at _____ a.m./p.m. You may either stay at school or take the vehicles home to complete the task. I have two hot glue guns that can be used, so it would be helpful if at least two of the volunteers also had hot glue guns that could be used.

Please write in your child's planner if you are able to help with this project. THANKS!



Name: _____

Rolling Along

Draw a picture of six objects in your home, garage, carport, or shed that has wheels.

Activity—May the Force Be With You

Standard III

Students will understand the relationship between an applied force and the resulting motion of an object.

Objective 2

Demonstrate that the greater the force the greater the change in speed or direction.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

**Standard
III**
**Objective
2**
Connections

Background Information

What a Load

The force of the car remains the same. Additional weight is added to each run. At first, the amount of washers (weight) added does not affect the toy's performance. Later on, each additional washer (increased weight) makes it more and more difficult to move the load. Finally, the load (weight/washers) cannot be moved by the amount of force applied.

Over the Edge

The sock filled with rice remains the same weight. As force (washers) is added to the paper clip, it reaches the point where the force is enough to move the weight. The greater the amount of force (# of washers), the greater the affect on the weight (sock), thus making the sock move across the tabletop and over the edge quicker.

Collision Zone

The balls are all the same size, but they are not all the same weight. The weight of each ball helps to determine how it will react when it collides with another ball. The material used to make each ball will also affect the experiment. Some materials absorb energy.

Straw Rocket

When the bottle is squeezed, the air is pushed up the smaller straw. The force of the air escaping from the smaller diameter straw pushes the larger diameter straw into the air. The greater the force, the greater the speed and distance traveled by the large diameter straw rocket.

Invitation to Learn

Launch your straw rocket. Ask the students, “What did you observe?”

Instructional Procedures

Materials

- wind-up moving toy OR pull string moving toy
- large paper clip
- 20 washers

Part 1: What a Load

Preparation

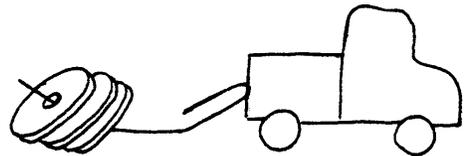
1. Bend apart the two loops of the paper clip (so it looks like an “S”).
2. Pull out the loose end of the larger loop.
3. Attach the smaller loop to the back end of the moving toy.

Activity:

1. Wind-up (or pull the string) on the toy and let it go. Observe the amount of time lapsed and distance traveled before the toy stops moving.
2. Predict what will happen as washers (weight) are added to the paper clip.
3. Place four washers on the paper clip, repeat step four. Compare the results to the first run.
4. Place six washers on the paper clip, repeat step four. Compare the results to the first two runs.
5. Place eight washers on the paper clip, repeat step four. Compare the results to previous runs.
6. Repeat step four, with two additional washers on each new run, until the toy cannot move the weight. Compare the results of each run with previous runs.
7. Discuss what is happening in this experiment.

What’s Happening?

The force of the car remains the same. Additional weight is added to each run. At first, the amount of washers (weight) added does not affect the toy’s performance. Later on, each additional washer (increased weight) makes it more and more difficult to move the load. Finally, the load (weight/washers) cannot be moved by the amount of force applied.



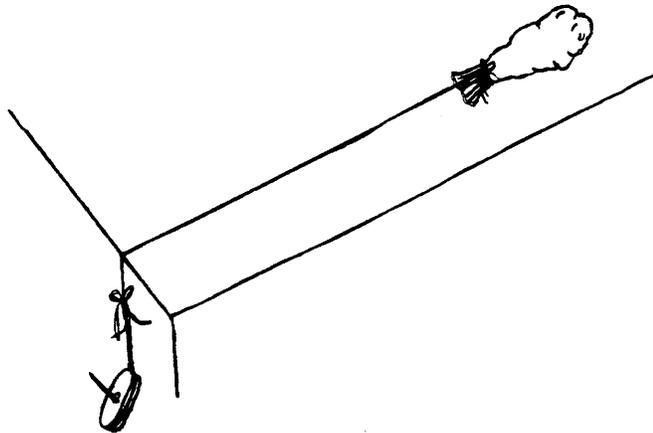
Part 2: Over the Edge

Preparation:

1. Fill the sock with one cup of rice and tie it shut with the 12" piece of string.
2. Attach the 36" piece of string to the cuff of the sock.
3. Bend apart the two loops of the paper clip (so it looks like an "S").
4. Pull out the loose end of the larger loop.
5. Attach the smaller loop to the loose end of the 36" piece of string.

Activity:

1. Place the bag of rice on a smooth surface (approx. 30" from the edge), with the end of the string with the paper clip, hanging off the edge.
2. Predict how many washers will need to be placed on the paper clip before the bag of rice begins to move.
3. Predict how many washers will need to be placed on the paper clip before the bag of rice is pulled over the edge of the table.
4. Start adding washers to the loose end of the paper clip until the bag of rice begins to move and eventually is pulled over the edge of the table. Compare the results to your prediction with the actual results.



What's Happening?

The sock filled with the rice remains the same weight. As force (washers) is added to the paperclip, it reaches the point where the force is enough to move the weight. The greater the amount of force (number of washers), the greater the effect on the weight (sock); thus making the sock move across the tabletop and over the edge more quickly.

Materials

- sock
- one cup of rice
- 12" piece of string
- 36" piece of string
- large paper clip
- 20 washers

Materials

- 1" balls of different weights (glass, steel, cork, wood, rubber, etc.) (per pair of students)
- two 1/2" wooden dowels (per pair of students)
- masking tape
- recording sheet (one per student)

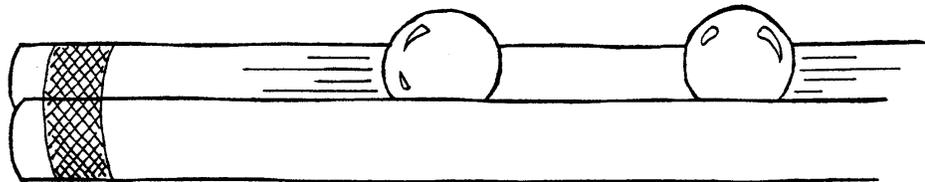
Part 3: Collision Zone

Preparation:

Tape the dowels together at each end.

Activity:

1. Place the dowels (ramp) on a flat surface.
2. Select the first two balls on the chart and place them on opposite ends of the ramp.
3. Predict what will happen when the two balls collide. Write your prediction on the chart.
4. Using the same amount of force, roll the balls towards each other. Write what you observe happening on the chart.
5. Repeat steps 3 and 4 until the students have investigated what happens when each ball has collided with another.



What's Happening?

The balls are all the same size but they are not all the same weight. The weight of each ball helps to determine how it will react when it collides with another ball. The material used to make each ball will also affect the experiment. Some materials absorb more energy.

Curriculum Integration

Math/Science

Objective 4:2 Use appropriate techniques and tools to determine measurement.

1. Measure and record the distance the wind-up or pull string toy goes each time.

Possible Extensions/Adaptations

Extension: Make a pinwheel and blow on it with different amounts of force.

Adaptation: All three main activities can be investigated by the students individually or in small groups at a learning station, or demonstrated to the entire class by the teacher.

Assessment Suggestion

Did the students complete the Collision Zone chart accurately? Did their prediction become more accurate the further they move down the chart?

Possible Resources

Books

Tell Me How Fast It Goes (Whiz Kids) by Shirley Willis (Franklin Watts)

Feel the Wind by Arthur Dorros (Children’s Books)

The Berenstain Bear’s Science Fair by Stan and Jan Berenstain (Random House, Inc.)

Gizmos and Gadgets: Creating Science Contraptions that Work and Knowing Why by Jill Frankel Hauser (Williamson Publishing)

Forces by Graham Peacock (Steck-Vaughn)

Laser Discs

Windows on Science, Primary Vol. 3, Force and Motion Lessons 6-10, 14-17

Websites

<http://www.enc.org/weblinks/science/0,1578,1%2DForces,00shtm>

<http://www.enc.org/weblinks/science/0,1578,1%2DMotion,00shtm>

Homework & Family Connections:

Have the student make a straw rocket at home.

Materials

- instructions
- soft plastic bottle, with pop-up lid
- two straws (one smaller than the other one in diameter)
- modeling clay
- scissors
- ruler

How to Make a Straw Rocket

Standard III, Objective 2, Activity 4

Materials Needed

- Soft plastic bottle, with a pop-up lid
- Modeling Clay
- Two straws (one smaller than the other one in diameter)

Directions

1. Cut both straws 6" in length.
2. Make four 3/8" slits around one edge of the smaller diameter straw.
3. Bend the four sections out (should look like an X or a + sign).
4. With the cap closed, place the slit end of the smaller straw in the center of the lid. Secure in place with the clay. This is your launch pad.
5. Make a nose for the rocket (large diameter straw) with a small amount of clay.
6. Slide the rocket over the launch pad.
7. PREDICT what will happen when the plastic bottle is squeezed firmly.
8. Actually squeeze the bottle and OBSERVE what happens.
9. Do it make a different how hard you squeeze the bottle? Try it to find out.



Name: _____

Collision Zone

	What do you predict will happen when the balls collide?	What did you observe happening when the balls collided?
Steel / Cork		
Glass / Wood		
Cork / Rubber		
Glass / Steel		
Wood / Rubber		
Cork / Glass		
Steel / Wood		
Rubber / Glass		
Wood / Cork		
Rubber / Steel		

***Science
Standard IV
Activities***

Activity—Weighing In

Standard IV

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

Objective 1

Demonstrate that gravity is a force.

Intended Learning Outcomes

1. Use Science Process and Thinking skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Standard IV

Objective 1

Connections

Background Information

The Earth's gravity pulls everything towards its center. Gravity gives objects their weight. The weight of an object is a measure of the pull of gravity on that object.

Invitation to Learn

Double Drop

1. Hold a sheet of paper and a ball at the same height.
2. Drop them (Aristotle's hypothesis predicts that the ball lands on the floor before the sheet of paper because the ball is heavier. And sure enough, the ball does land first, but not because of Aristotle's hypothesis).
3. Crumple the paper into a wad—the same size as the ball.
4. Hold the wad and the ball at the same height and drop them.
5. Discuss what is happening. The ball and the paper land at the same time. The paper hasn't gotten any heavier; it's just a different shape. A round wad of paper can push air out of the way more quickly than a flat sheet of paper. If there was no air to push out of the way (air resistance), even the sheet of paper would plummet at the same speed as the ball.

Materials

- golf ball
- one sheet of ditto paper
- Assorted Classroom Objects
- Spring Scale (0 – 2000 grams)

Instructional Procedures

1. Estimate the order of the weight of various classroom objects from lightest to heaviest.
2. Measure the weight of each object using the spring scale.
3. Compare the actual results with the estimates in step one.
4. Place the objects in the correct order from lightest to heaviest.

Curriculum Integration

Math/Science

Objective 1:3 Identify the relationship between whole numbers

1. Place the objects in sequence according to their weight from lightest to heaviest.
2. Order and compare the weights of the objects by plotting them on a number line.
3. Compare the relationship (“<”, “>” and “=”) between the weights of the objects.

Objective 3:2 Describe spatial relationships.

1. Make a grid of the floor tiles (flight path) and indicate where the paper airplane landed.

Possible Extensions/Adaptations:

Extension: Put one cup of various items (marshmallows, gravel, rice, beans, cereal, etc.) into individual sturdy cups. Have the students complete the instructional procedures above for these items.

Adaptation: The main activity and the extension can be investigated by the students individually or in small groups at a learning station, or cooperatively by the whole class.

Assessment Suggestion

Did the student(s) accurately read the spring scale?

Did the student(s) place the objects in the correct sequence from lightest to heaviest?

Possible Resources

Books

Gravity by Dan Greenberg (Newbridge Education Publishing)

The Magic School Bus Plays Ball by Joanna Cole (Scholastic Inc.)

Gravity: Simple Experiments for Young Scientists by Larry White
(Millbrook Press)

Bowled Over: The Case of the Gravity Goof-Up by Chuck Harwood
(McGraw Hill Trade)

Why Doesn't the Earth Fall Up? by Vicki Cobb (Lodestar Books)

Which Way Is Up? by Gail Kay Haines (Simon & Schuster)

Videos

Gravity is Attractive: What is Gravity?

Laser Discs

Windows on Science, Primary Vol. 3, Force and Motion Lessons 12 + 13

Websites

<http://www.enc.org/weblinks/science/0,1578,1%2DGravity,00shtm>

<http://www.lessonplanspage.com/ScienceSSmars7>

Homework & Family Connections

Defying Gravity

1. Challenge the students to design and make a paper airplane that will defy gravity, by flying in the straightest and furthest path.
2. Have the students bring their airplanes to school the next day for test flights.
3. Have one student at a time fly their airplane. This is best done in a hall with tile on the floor.
4. Record the results. To determine each student's result: Count how many tiles out from the starting line. Then, subtract the number of tiles off course (to the left or right).
5. Analyze which airplanes were the most successful in meeting the criteria and why.
6. Are there some variables in the experiment that could possible influence the results? How could we control those variables?

Activity—Roller Coaster Fun

Standard IV

Objective 2

Connections

Standard IV

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

Objective 2

Identify the effect of gravity on the motion of an object.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Background Information

Gravity is the force that pulls objects towards the Earth. Gravity pulls you down when you jump off the chair, but you're fighting gravity when you jump back up. Gravity is pulling the ball/marble down the track, but the ball/marble is fighting gravity when it goes uphill. The speed of the ball has to be great enough to get the ball down a hill and back up to the top of the next hill.

Invitation to Learn

Chair Jumping

1. Stand on the seat of the chair
2. Jump off the chair.
3. Jump back up onto the seat of the chair.
4. Discuss which was easier: jumping off or jumping back up onto the seat of the chair.

Materials

- Sturdy Chair
- One pipe insulator (split in half lengthwise) (per group of 2-4 students)
- Balls of various masses (e.g. steel, glass, cork, wood, rubber) (per group of 2-4 students)
- Masking tape (one roll per group of 2-4 students)

Instructional Procedures:

Preparation

Tape the two halves of the pipe insulator together.

Activity

1. Divide the class into cooperative learning groups of 2-4 students per group.
2. Design a roller coaster and tape it the design to the wall.
3. Place one ball at the beginning of the track.

4. Let go of the ball and observe what happens as the ball rolls up and down.
5. Repeat steps 3 and 4 with different balls and marbles.
6. Modify your track and repeat steps 3 through 5.
7. Analyze the results – Which ball worked best? Why? Which track design worked best? Why?

Curriculum Integration

Math/Science

Objective 3:1 Describe and identify geometric shapes.

1. Draw a line segment illustrating the shape of your roller coaster. Identify the starting and ending point.

Possible Extensions/Adaptations

Extension: Challenge the students to put two 20 ft. lengths of pipe insulator together and construct a successful roller coaster design.

Adaptation: Make mazes or ramps out of cardboard tubing.

Assessment Suggestion

In their journals, have the students draw a picture of the roller coaster built by their group. Have the students write about their design and why it works relating to the force of gravity.

Did the student(s) work cooperatively in their group(s)?

Were the students able to analyze any defect(s) in their design and come up a proper solution(s)?

Were the students able to construct a successful roller coaster?

Possible Resources

Books

Looking Inside Sports Aerodynamics (X-Ray Vision) by Ron Schultz
(Larousse Kingfisher Chambers)

Experiments with Gravity (True Books) by Salvatore Tocci, Robert Gardner, Nancy R. Vargus (Scholastic Library Publishing)

The Science Book of Gravity by Neil Ardley (Gulliver Books)

Videos

Roller Coaster!

Laser Discs

Windows on Science, Primary Vol. 3, Force and Motion Lesson 11

Websites

<http://www.enc.org/weblinks/science/0,1578,1%2DGravity,00shtm>

<http://www.lessonplanspage.com/ScienceSSmars7>

Homework & Family Connections

Have the students design and build OR make an illustration of a roller coaster, ramp, or maze at home. Have the students bring the roller coasters, ramps, and mazes to school and set-up an amusement park.

Science
Standard V
Activities

Activity—Is It Hot in the 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.

Objective 1

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

Intended Learning Outcomes

1. Use science process and thinking skills
4. Communicate effectively using science language and reasoning

Standard V

Objective 1

Connections

Background Information

Careful observation and measuring are important steps in scientific investigations. Students at this age are usually encouraged to observe similarities and differences or even changes in objects. Good observations include using as many of the senses as possible - sight, touch, hearing, taste, and smell. It includes picking things up and touching them, feeling them, etc. Challenge students to observe carefully, so they can notice when changes are happening.

Learning to use a thermometer will help students make quantitative observations, in which they will be able to tell exactly what the temperature is, or whether something is becoming warmer or colder. Students should practice holding the thermometer by the edges, and not on the glass bulb, to get an accurate reading.

Heat is the name given to the flow of energy from hotter to cooler objects. Temperature is the measurement of how hot or cold something is. In hotter substances, the molecules are moving very rapidly, while in colder substances, the molecules slow down.

Most of the heat found on Earth comes from the sun, and is used by all living things. This heat travels by radiation through invisible rays from the sun.

In this activity, students will make observations that things in direct sunlight are warmer than things that are not in as much sunlight. Also, they may notice that there may be more heat near asphalt, brick, or cement because heat can be stored and radiated from these, also.

Invitation to Learn–Option 1

Before Handing out Thermometers: Start a game of I Spy in the classroom, in which students are given clues to certain things in the room, which they identify. (For example: I spy something that is a round sphere. It can spin around. One of its colors is blue. Can anyone guess what it is? You're right – it's the globe). Tell students that one of the things scientists do very well is to make good observations.

Hand out material to be observed to students (peanuts, shells, buttons, types of cereal, etc.). Encourage students to make observations.

Hand out two UV beads per student. Do not tell them what they are, but ask students to make observations about them. Tell student you would like them to make a bracelet for these, and they can wear them all day while they make observations. At the end of the school day, you will ask them what observations they made.

Invitation to Learn–Option 2

Have the students go on an imaginary hike to a cave with you (an optional script is attached, or just tell the students about going in a cave). Have students imagine they are hiking up the trail with you, and it is a long, hot hike. Then describe how cold it is in the cave. When the lights are turned off, have the students close their eyes and shiver with you. With their eyes closed, they can't see anything. They can rub their hands together to try to get warm, but it is cold and dark. When they are finally through the cave, they can open their eyes, and stretch out their arms to the sun to get warm. Ask how many have been in caves. Is it hard to see? Is it cold? It is so nice to have light! Where do our lights come from?

Instructional Procedures

1. While writing on a poster or on the board, have students share examples of light sources.
2. Do we get heat from light sources? What are some examples? Could it be cold in the light? What are some examples?
3. Tell students they will be going outside as a class to find some warm places in the light, and some cool places. Divide the groups in half, and have half try to find the coolest place they can on the school grounds, and the other half try to find the warmest.
4. Instruct students how to use thermometers. You may want to have them practice taking the temperature of the room, cold water, etc., to be sure that they know how to read the thermometer. Each group will be given a thermometer and a worksheet, and they

must stay together as a group. After a few minutes of exploring, they must choose a spot, set out the thermometer, and wait several minutes for an accurate thermometer reading.

Some suggested rules while students are outside:

- They must stay within sight of the teacher.
 - They must choose a spot in five minutes.
 - The teacher will call off each minute, so everyone is taking a temperature reading each minute for 3 to 4 minutes.
 - While they are waiting, they may draw on their worksheet where they are relative to the school building.
 - Students will mark how much sunlight is by their spot: not colored in at all for full sun, or partially/fully colored in if in partial sunlight or shade.
 - They should write down the temperature each time the teacher calls out a minute.
 - Everyone in the group should agree on the final temperature.
5. Return with students to the classroom, and write down each group number along with their recorded temperature(s) and amount(s) of sunlight.
 6. Students will draw on their thermometers what the temperature and sunlight was for each group, then place the temperature in order on the chart from hottest to coldest.
 7. Discuss with students what might have made the difference in temperature and discuss how things in direct sunlight are usually warmer than those not in direct sunlight.

Curriculum Integration

Math/Science

3rd Grade Math, Standard IV, Objective 2g: Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer.

Standard V, Objective 1: Collect, read, represent, and interpret data using tables, graphs, and charts. Make predictions based on a data display.

Materials

- shells, peanuts, etc. for observations
- 2 UV beads and a pipe cleaner per student
- 8 thermometers (1 per group)
- 8 cups of ice water
- “How Hot or Cold Is it?” Worksheet and clipboard per student or group
- “From Hottest to Coldest” Worksheet per student

Possible Extensions/Alteration

If students are wearing UV bracelets during this activity, discuss what is happening when they observe the changes in the beads. Are the beads as bright in the shade as they are in the direct sunlight? Are they all the same color? Students may want to experiment with putting sunscreen on some to see if it changes the bead color.

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 than warm-blooded animals? How?

Assessment Suggestion

Check student worksheets to see if students correctly drew the temperature for each group, and correctly put the temperatures in order from highest to lowest.

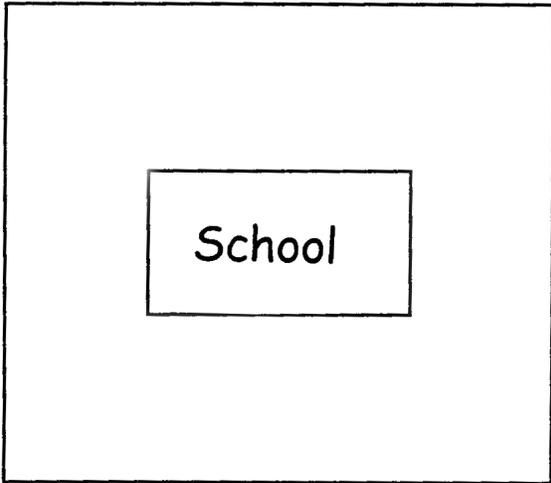
Homework & Family Connections

Mention in a parent letter that students are learning to measure with thermometers, and ask parents to point out thermometers around the house.

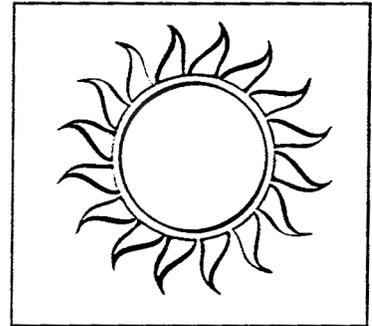
Name: _____

How Hot or Cold Is It?

Location:



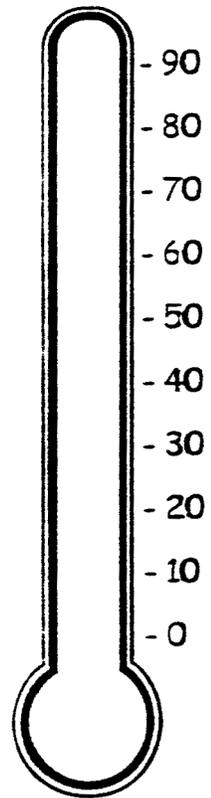
Amount of sunlight:



Time: Temperature

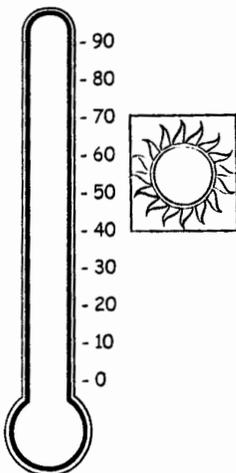
Time:	Temperature
1 minute	
2 minutes	
3 minutes	

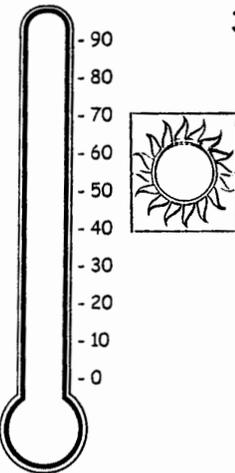
Final Temperature:

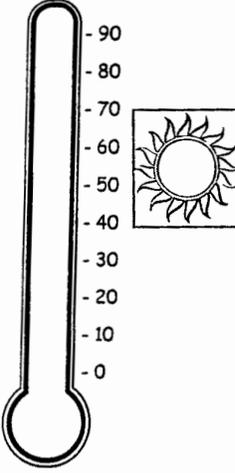


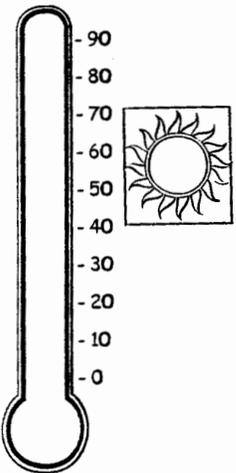
From Hottest to Coldest

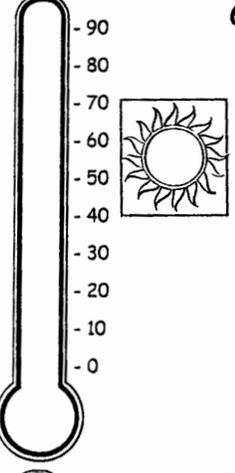
Draw the temperature of each group, then place them in order from hottest to coldest.

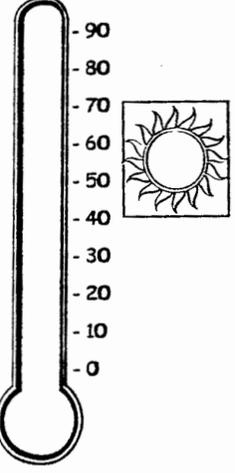
1. 

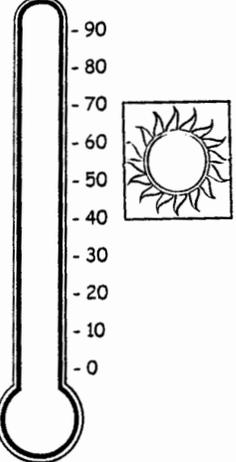
2. 

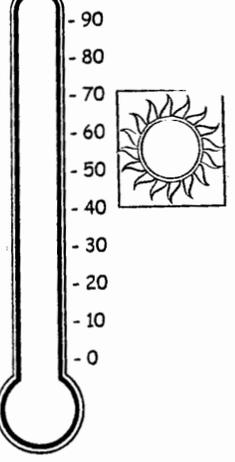
3. 

4. 

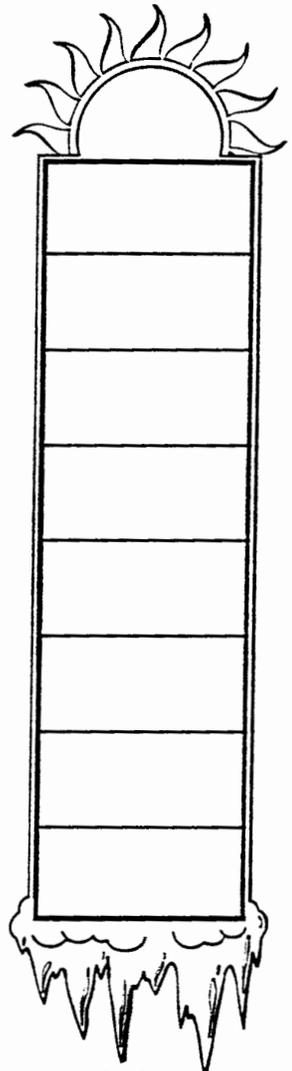
5. 

6. 

7. 

8. 

Hottest



Coldest

How much light was in the hottest areas? _____

How much light was in the coolest areas? _____

Cave Hunt

By Annette Van Wagenen

We're going on a cave hunt.
We're visiting Timpanogos
We're hiking up the long trail.
The trail is steep and winding.
The summer sun is very hot.
But we've got a canteen of water.

At last we're at the entrance
A guide will take us through.
Look at all the cave tunnels and caverns.
This cave is beautiful, wet, slippery, and cold (brrr)
We forgot to bring our jacket.
Let's rub our hands together.
We're creating heat through friction.

The guide says he's turning out the electric lights.
No, they are dim and barely illuminate.
He now is turning off his flashlight.
I can't see my friends standing near me.
Aaah, it's too quiet;
But now, what is that noise?
Could it be bats?

Grab a flashlight and
Let's get out of here.
We run pass the stalactites,
Pass the stalagmites, the cave coral and the soda straws:
The columns, the flowstone, and the draperies. We
Keep going until at last we come to the end of the cave tunnel and go outside.
It will take a few minutes for our eyes to adjust to the bright sunlight. The
Hot summer sun feels good after being inside that cold cave. Let's go down
The trail now. But we won't run, we'll walk!

Sources of Heat

Tune: “My Bonnie Lies Over the Ocean”

Oh, we can make heat with rubbing,
And heat from machines can be fun . . .
A hot tub will help us keep cozy,
But most of our heat’s from the sun.

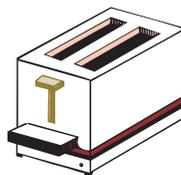


Chorus:
Heat and light can warm us.
Heat from the sun will help plants to grow.
Sunlight helps all creatures
That live on the earth, and below.

Mechanical machines are helpful
They work without electrical power,
Like biking and cutting and mowing,
They produce some heat and some power.



Electrical machines are common,
Like everything that has a cord.
A lamp, stove, TV, or heater,
And battery-powered toys.



Rubbing two things together
Will create a little heat
Like sticks, hands, balloons, and paper.
I really think rubbing is neat.

Words by Vickie Ahlstrom

Sunlight

By Annette Van Wagenen

(Tune: Battle Hymn of the Republic)

Mine eyes have seen the beauty of the plants that grow on earth,
They need sunlight, heat, and water to refresh a rich, green turf.
Living mammals use the heat and glow of sunlight since their birth.
It all comes from the sun!
Sunlight, sunlight, hallelujah,
Sunlight, sunlight, hallelujah,
Sunlight, sunlight, hallelujah,
It makes our planet green.

We have sunlight in the daytime; but it's dark and cold at night
It makes all of us feel better to have artificial light
Flashlights, candles, lanterns, light bulbs will illuminate so bright
Light brightens us our lives.
Sunlight, sunlight warms and heats you
Sunlight, sunlight makes the sky blue
Sunlight, sunlight is the ruler,
It keeps the world alive.

When two objects rub together, friction causes manmade heat,
It might be something electric like an oven roasting meat.
It could be a mechanism to unseal a can of beets,
Heat livens up our world.
Heat and light can go together.
Heat and light is a good mixture
Heat and light can be for pleasure.
It makes the world go round.



Activity—Green Apples

Standard

V

Objective

1

Connections

Standard V

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

Intended Learning Outcomes

1. Use science process and thinking skills
4. Communicate effectively using science language and reasoning

Background Information

All seeds have enough food inside to start to grow. Seedlings in light will grow green and strong. Seedlings in the dark will grow weak and yellow. Plants need light to make food. Without light, plants will lose their color and soon die.

Invitation to Learn

Show the students a large piece of white batting cut into the shape of an apple. Ask them, “How can I turn this white material green?” Let the children brainstorm for answers. Next tell them that you have a very special way to change the color.

Instructional Procedures

1. Place the batting in the pie tin. Wet it all over. Sprinkle alfalfa seeds on top so that it covers the batting. Spray with spray bottle to wet the seeds. Repeat with a second batting of alfalfa seeds.
2. Put one of the pie tins in the sunlight and the other in a dark cupboard
3. Give each child the student worksheet on seed observation.
4. Each day water the sprouts in the morning and afternoon. On the first, third, fifth, and seventh days have the children write what they observe on the observation sheet.

Materials

- A piece of batting cut into an apple shape
- Pie tin
- Alfalfa sprouts
- Spray bottle
- Two paper cps for each child
- Six lima beans

Second Experiment

1. Take two paper cups and six lima beans. Fill both cups nearly to the top with soil. Put three seeds in each cup. Plant them so they are about 1 inch deep.

2. Add enough water to each cup to make a small puddle on top. Place one cup in a dark cupboard. Place the other in a bright sunny windowsill. Each day add a teaspoon of water to each cup. In a few days, seedlings will start to sprout in both cups.
3. Leave the cups where they are. Continue to water the plants in an identical manner. In a few more days, the plants in the sunlight will be big and healthy, but the plants in the closet will stop growing and die.

Curriculum Integration

Math/Science

3rd Grade Math Standard IV, Objective 2a: Measure the length of objects to the nearest centimeter, meter, 1/2 inch, foot, and yard.

Possible Extensions

1. Have children experiment with placing seeds in different places. One pan of seeds could be placed in the refrigerator, on the counter, or near a heating vent. Predict what will happen. Check the plants daily and record your observations.
2. Students could start seeds in bottles with dark paper placed on the bottles in different ways. As plants start to grow, they will bend toward the light in different ways.

Assessment Suggestion

See how well the students follow directions.

Have the students observed and recorded accurately on their worksheet?

Additional Resources

Books

Who Eats What? by Patricia Lauber (Harper Collins Publishers)

Seeds by Melvin Berger (Scholastic)

The Nature and Science of Seeds by Jane Burton (Garth Stevens Publishing)

Outdoor Science Adventures by Melvin Berger (Scholastic)

What Shall I Grow? by Ray Gibson (Scholastic)

How do Plants Get Food? by Melvin Goldish (Raintree Steck-Vaughn)

Food by Sally Hewitt (Children's Press)

What is a Plant? by Bobbie Kalman (Crabtree)

Do You Know How Plants Grow? by Stephen Parker (Warwick Press)

Videos

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

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

Websites

www.dole5aday.com/about/citrus.oranges.html

www.icangarden.com/kidz.htm

www.arborday.net/kids/kid_links.htm

Homework & Family Connections

Have the children talk with their families about gardening. Perhaps they can plan a family garden together. Visit a nursery to view all the variety of seedlings that are growing. Talk about the conditions in a nursery that make growing plants so ideal.

Name: _____

Ralphie is Hot!

Draw five ways to protect Ralphie from the heat of the sun.



Name: _____

Observe the Growth of Alfalfa Sprouts

Seeds Placed in Sunlight			
	Color	Measurement	Observation
Day 1			
Day 3			
Day 5			
Day 7			

Seeds Placed in Closet			
	Color	Measurement	Observation
Day 1			
Day 3			
Day 5			
Day 7			

Name: _____

Did You Use the Sun Today?

At different times during the day, write down what you are doing.

Are you using sunlight in any way? (Are you eating food that used sunlight to grow?)

If you use sunlight in any way, write down how it is being used.

Time	Activity	Sunlight Used?		How
		Yes	No	

In what ways do we use sunlight every day? _____

Did you do more things that used sunlight, or didn't use sunlight? _____

Activity–It’s Hot

Standard V

Objective 2

Connections

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.

Intended Learning Outcome

1. Use science process and thinking skills

Background Information

Without the warmth of the sun’s rays, Earth would be frozen. Even at 93 million miles away, the sun warms Earth just enough to provide for the existence of people and animals. Depending on the sun’s position, living things are affected differently.

Instructional Procedures

Materials

- Bag of clothes with the following items: coat, jacket, gloves, hat, scarf, earmuffs, sunglasses, shorts, lightweight shirt, sandals, swimming suit
- Aluminum foil
- Chocolate chips
- 2 squares graham crackers for each child
- mini marshmallows
- 1 large cake pan for each group of 8 students

1. One at a time, have each child pick an article of clothing out of the bag. Depending on the article they choose, have them stand by a sign saying “Hot Day,” or a sign reading, “Cold Day”. Discuss why there is a difference in the clothes we wear. Talk about how to stay warm in winter and cool in summer. Explain some misconceptions (misunderstandings) about heat sources here and in Heat Misconceptions Activity. One example would be that wool clothing does not produce heat and make you feel warmer.
2. Teach the children about sun safety. Too much sun can hurt our skin. Have the children add things on the “Ralphie is Hot” worksheet to protect him. These things include sunscreen, drinking water, hat, shade, or sunglasses.
3. Make a solar cooker during this lesson, or have students check out the Heat Science Kit, which includes instructions for making a solar cooker. Cook with the sun’s rays by “toasting” graham cracker sandwiches the solar way! Divide into groups of three or four and give each group a large cake pan. Have each group line its container with aluminum foil (shiny side out). Each group member will place some chocolate chips and marshmallows on a graham cracker square and set it in his or her group’s container. Have them cover the containers with paper toweling and observe how long it takes for the chocolate and marshmallows to melt. After this treat has been “toasted,” let each child place another

graham cracker square on top of the melted goo to make a sandwich. While each group shares its results with the class, let the children enjoy their solar snack. Discuss if this experiment would work in another season.

Curriculum Integration

Math—Employ estimation strategies by predicting the amount of time needed to cook the graham cracker sandwiches.

Possible Extensions/Adaptations

The students draw a picture about animal survival. Draw several pictures of how animals survive in winter and several drawings of heat adaptations for animals.

Have the students decide other things that could be cooked in a solar cooker. Decide where the most effective places for solar cooking might be.

Assessment Suggestions

Give each child a small Carson-Dellosa Sunshine, or cutout sunshine, stapled with four blank yellow 3" x 3" yellow sticky notes. Have the children write at least four things that they learned about the sun. If they want to write more, they can write on the backs of the paper.

Additional Resources

Books

Light and Dark by Jack Challoner (Raintree Steck-Vaughn Publishers)

The Night Book by Pamela Hickman (Kids Can Press)

The Sun Space Observer Series (Heinemann Interactive Library)

The Mountain that Loved a Bird by Alice McLerran (Scholastic)

Homework and Family Connections

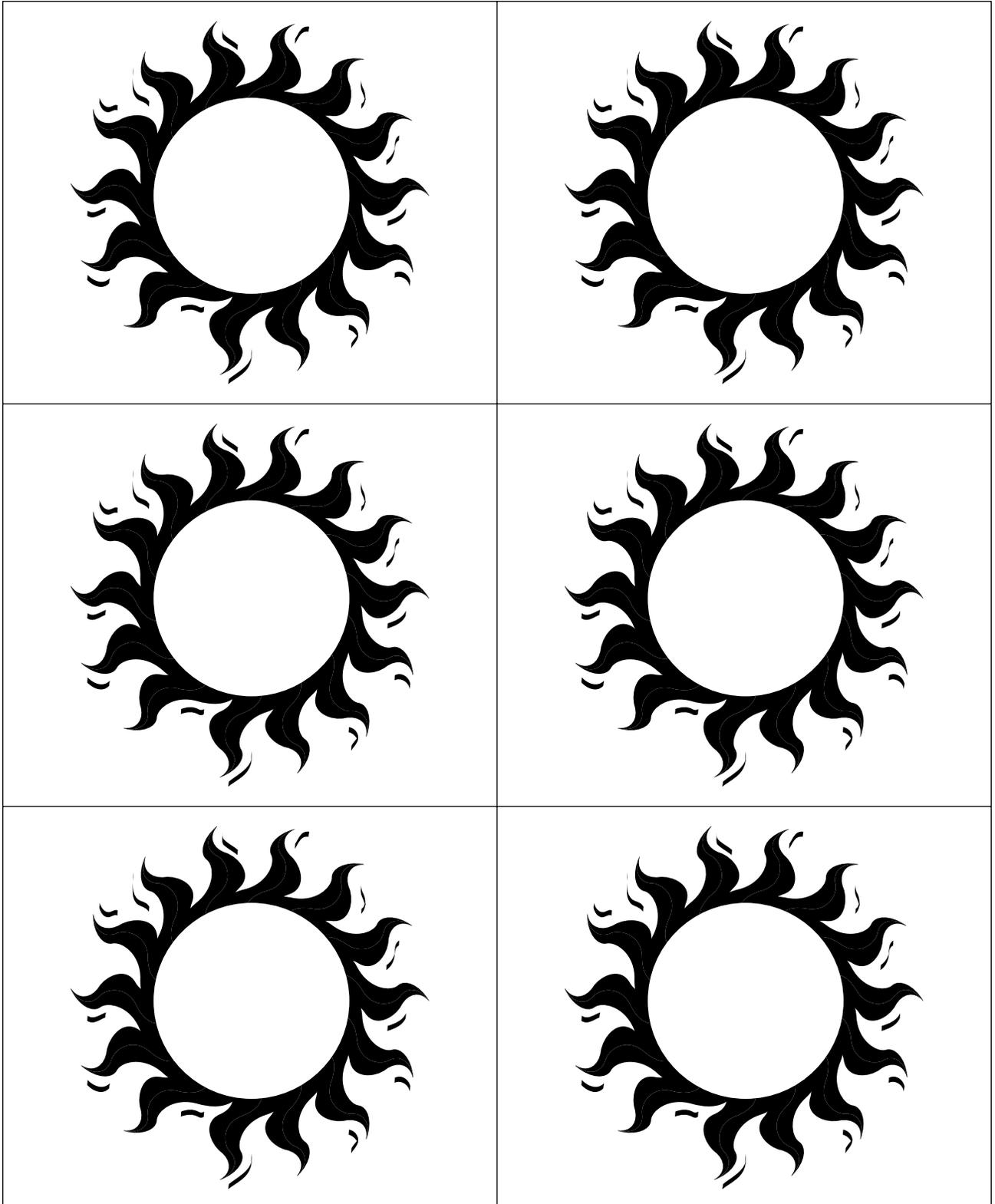
Students could check out the Heat Science Kit.

Caroling is an activity associated with cold, winter weather, hot chocolate, favorite songs, and warm feelings. Choose some favorite summer songs. When the class has had several practice sessions, set a date for caroling. Ask other teachers in the school if your class may carol for their classes. Then lead your group through the hallways, stopping at

doorways to sing for each class. Be sure to tell the children to wear sunhats, sunglasses, sandals, and other appropriate summer attire. Serve a cool treat such as refreshing lemonade when you return to your classroom.

Tell the children to go home and sing some of these songs for their families and plan a neighborhood summer activity. Have them report on their plan and ask if their family actually carried it out.

Sunshine Cutouts



My Book About Heat and Light

Name: _____

Insulators

Question: Which material will keep heat in the longest?

Hypothesis: I think _____

Materials: You will need 1 styrofoam container, 1 folded newspaper, 1 towel, and 3 small cups. Use the thermometers from your kit.

Steps:

1. Fill 3 small cups with hot water.
2. Take the temperature of each cup.
3. Wrap each cup with an insulator.
4. Measure the temperature of each cup every minute for 4 minutes.

Conclusion:

	0 minutes	1 minute	2 minutes	3 minutes	4 minutes
Cup in newspaper					
Cup in styrofoam					
Cup in towel minu					

Hot to Cold

Question: Which room in your house is the hottest? Whis room is the coldest?

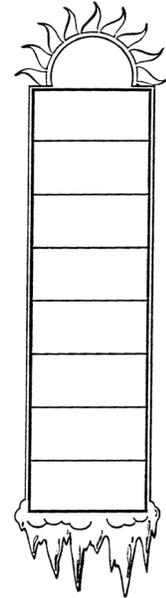
Hypothesis: I think _____

Materials: Use the thermometers from your kit.

Steps:

1. Measure the temperature in six rooms.
2. Leave the thermometers for 5-10 minutes.
3. Also observe how much sunlight in each room.

	Room	Temperature
1.		
2.		
3.		
4.		
5.		
6.		



Solar Cooking

Question: How can I use the sun’s heat to cook my food?

Hypothesis: I think _____

Materials:

- 1 bowl covered in foil (shiny side out)
- clear plastic wrap to cover top
- marshmallows

- 1-2 graham cracker squares
- chocolate chips



Steps:

1. Place graham cracker in bowl.
2. Place chocolate chips and marshmallow on top of cracker.
3. Cover with plastic wrap.
4. Place in direct sunlight.

Conclusion:

Sprouts!

Question: Do seeds need heat to sprout?

Hypothesis: I think _____

Materials: From the kit, find the following:

2 plastic bags
seeds

4 cotton balls

Steps:

1. Place 2 cotton balls in each bag.
2. Place a few seeds on the cotton and slightly moisten with water.
3. Place 1 seed bag in a cool or cold area.
4. Place 1 seed bag in a warm area.
5. Observe for one week.

Conclusion: Which seeds grew better?

Observations:

Heat From Rubbing!

Question: Which two things rubbed together make the most heat?

Hypothesis: I think _____

Materials:

1 thermometer or heat sensor

Items to test

Steps:

1. Choose items from around the house to rub together (wood, rubber, plastic)
2. Take the temperature before and after rubbing.

Conclusion: Which made the most heat?

Item 1	Item 2	Time	Temperature

Heat From Machines

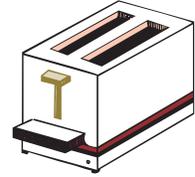


Question: Which machines in your house give off the most heat?

Hypothesis: I think _____

Materials:

Thermometers from the Science Kit



Steps:

1. Take the temperature of the machine.
2. Tape or attach a thermometer to it.
3. Turn the machine on for five minutes.
4. Test the temperature after another 5 minutes.

Conclusion: Which made the most heat?

Machine	Temp. While Off	5 Minutes	10 Minutes	Difference

Dear Parents,

Your child has checked out a Heat Science Kit, with materials included to do some science experiments at home. This kit is provided so that families may be actively involved in doing science together. This kit has been checked out for one week, and then needs to be returned to the classroom.

Please be sure that the thermometers and heat sensor are returned with the kit. Your child may keep all other materials, including their Experiment Booklet.

Suggestions for using the kit:

- Reserve 30 - 60 minutes for the kit activities during the week.
- Listen to each other.
- Offer assistance only when needed.
- Ask questions such as . . .
 - **What** happened?
 - **Why** do you suppose that happened?
 - **Where** have you seen this happen before?
 - **What** do you think would happen if . . .?
- Accept answers your child gives.
- Enjoy the time together!

Activity–Heat Misconceptions

Standard
V

Objective
1

Connections

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.

Intended Learning Outcomes

1. Use science process and thinking skills
3. Understand science concepts and principles

Background information

Heat is the name given to the flow of energy from hotter to cooler objects. Temperature is used to measure the amount of heat energy. A temperature reading is the average amount of energy movement in a substance. The molecules in cold things move very slowly and the temperature lowers. Cooled substances usually shrink (contract) and become smaller. The molecules in hot things move very quickly, and the temperature rises. Hot substances usually expand when heated.

When a hot substance comes in contact with a cold substance, the heat energy will flow from hotter to colder, until the objects become the same temperature.

Insulators are materials that block the flow of heat, while conductors are materials that allow heat to flow easily. Sometimes students believe that insulators are really heat sources, because they seem to make things warm, or heat things up. Insulators will stop the heat from flowing, so things that are warm tend to stay warm, but they are not a heat source. Good insulators include plastics, air, fabrics that hold air, feathers, or other similar materials.

Invitation to Learn

Invite a student to come to the front of the room, and hand the student an ice cube to hold (can put in sealable bag). Ask the student what is happening. Clarify that the ice is not bringing cold to the hand, but is heat is moving from the warm hand to the ice cube, until eventually they become the same temperature. When their hand is cold, sometimes people also believe that it is their gloves that keep them warm.

Instructional Procedures

1. Use several different types of gloves, and ask students to predict if these gloves would warm up their hands. Does one glove work better than the other?
2. Divide students into four groups and hand out a worksheet for each student.
3. Each group will set the glove or coat on a counter out of direct sunlight and place a thermometer in each glove, and one thermometer on the counter.
4. After 5 minutes, check the thermometers. The temperatures should both be the same.
5. Discuss what has happened so far. Do gloves make your hands warm? They seem to. Have one student in the group put the glove or coat on, with a thermometer touching them.
6. After 5 minutes, record the temperature on each thermometer.
7. Now put the thermometer back in the glove only, and let them sit again for five minutes. What is the temperature now?
8. Draw a conclusion: Gloves do not give heat, but will insulate, or hold in any heat, that is in your hand. As long as a warm hand is in the glove, the glove will be warm. If the hand is removed, then the glove returns to room temperature.
9. Have students complete the worksheet, fill in their observations, and record a new science question.

Grading student worksheet:

- 10 points correct, complete, detailed
- 8 points partially correct, complete, detailed
- 6 points partially correct, partially complete, lacks some detail
- 5-1 points incorrect or incomplete, missing data, needs help

Curriculum Integration

Math/Science

- 3rd Grade Math, Standard IV, Objective 2g: Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer.

Materials

- ice cubes in sealable bags
- 8 thermometers (be sure all thermometers have the same temp.)
- assorted gloves, mittens, coat, etc. So each group of students has something to experiment with
- Experiment Worksheet

Possible Extensions/Adaptations

Some students may also try different experiments, such as how to keep an ice cube the coldest, or how to melt an ice cube the soonest. The experiment worksheet will work for any student experiments.

Discuss the different temperatures found in ecosystems around the world. What do animals that live in very cold places do to survive the cold? What kind of insulators do they have?

What types of materials make good insulators?

Assessment Suggestion

If you have gone over both how heat flows and if gloves keep hands warm, then you may have students complete the True/False worksheet.

Another assessment is to use the Heat Story Master, and have students write what they know about heat.

Additional Resources

Books

Make it Change by David Evans (Dorling Kindersley)

Experiment with Heat by Salvatore Tocci (True Books)

Its Much Too Hot! An Early learner Book About Heat by
Bob Graham

Websites

www.sciencelinks.com

Homework & Family Connections

Insulator Activity in the Heat Experiment Kit.

Name: _____

What I Know About Heat



Write a “True” or “False” by each statement about heat.

- _____ 1. When I touch a cold rock with my warm hand, my hand will get warmer because heat travels from hot to cold.
- _____ 2. When I touch a cold ice cube with my warm hand, my hand will get colder because heat travels from hot to cold.
- _____ 3. My gloves keep my hands warm because they produce heat.
- _____ 4. A cold snowball will give off cold air.
- _____ 5. A warm cup of hot chocolate will take heat from my cold hands.
- _____ 6. My hat keeps my head warm because it traps the heat from my head.

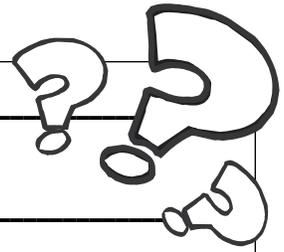
Draw a picture of how heat travels when you hold an ice cube in your hand.

Name: _____

My Science Experiment

My Question: _____

_____?

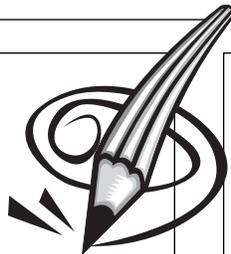


My Hypothesis
I think _____

_____.

My Materials

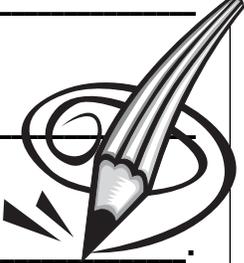
My Plan



My Observations	My Results
See _____ _____	
Smell _____ _____	
Touch _____ _____	
Hear _____ _____	



My Answer to the Question: _____



My New Question: _____

_____ ?

Heat Story

1. Where does heat come from?

2. Write three things you know about heat!

- ---
- ---
- ---

3. Write the most interesting thing you learned about heat.



Activity—The Little Orange Rooster

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 2

Demonstrate that mechanical and electrical machines produce heat and sometimes light.

Intended Learning Outcomes

1. Use science process and thinking skills
3. Understand science concepts and principles

Standard V

Objective 2

Connections

Background Information

Heat energy can be produced by mechanical and electrical machines, and can sometimes produce light. Mechanical machines are those which do not use electricity, such as machines that use fuel (cars, lawnmowers), human strength (bikes, skateboards), or flowing water (water turbine). Classroom examples of mechanical machines include using scissors, a stapler, or a pencil sharpener.

Electrical machines include those which use electrical power and would have a plug or use batteries. Classroom examples include an overhead projector, electric pencil sharpener, computer, heat lamp, TV, or VCR.

Invitation to Learn

Ask students for some examples of heat sources - things that produce heat. Write them on the board. If machines are not mentioned, talk about some machines that also give off heat, even if they are used for something else. Has anyone every felt the back of a computer? Sometimes that is warm. Light bulbs can get so hot that you could burn yourself if you touched one while it was still on.

Today, we're going to hear a story about a Little Orange Rooster. While listening to the story, think about all the machines that he and his friends use, and think about if those machines would get warm or not.

Instructional Procedures

Materials

- Little Orange Rooster story
- 1 slice of bread per student
- Heat Sources Worksheet
- food coloring
- 4 containers
- 2 cups of milk
- Toaster
- 1 paintbrush per student

1. Read the story of the Little Orange Rooster.
2. Discuss with students the different machines that they used. Some of those machines were mechanical; they had motors that used gasoline. Some of the machines were electrical; they were plugged in or used batteries.
3. Help students classify which were mechanical and which were electrical.
4. Hand out the Mechanical and Electrical worksheet, and instruct students to draw 4 examples of each type of machine.
5. Sometimes machines that produce heat also produce light. Have students complete the worksheet by drawing some mechanical and electrical machines that produce light as well as heat.

Curriculum Integration

Math/Science

3rd Grade Language Arts, Standard I, Objective 1b: Listen and demonstrate understanding by responding appropriately (e.g., follow multiple step directions, restate, clarify, question, summarize).

Possible Extensions/Adaptations

Students can be challenged to make a list of as many mechanical and electrical heat sources as they can find, with extra credit being given to all students who make of list of at least 25 machines.

Students may choose to classify machines as those which give off a lot of heat, and those which give off a little heat. They may also classify machines that give off heat, but no light, and those which give off heat and light.

Assessment Suggestion

1. Have students complete the writing activity in which they fill in the words to the story.
2. Have students draw a picture of their favorite electrical or mechanical machine in the following way:
 - a. Teacher will pour 1/2 cup of milk into four small bowls.
 - b. Put two drops of food coloring in each bowl (one color per bowl).

- c. Have students use a clean paintbrush and paint a picture of their favorite machine on one side of the bread. The picture should only be outlined, so the bread won't get soggy. Then they will paint an "M" for "mechanical", or an "E" for "electrical", to show what type of machine it is.
- d. Toast the bread in a toaster.
- e. Spread with butter and jam if desired.

Additional Resources

Books

Science Book of Energy by Neil Ardley (Dawn Publications)

New Way Things Work by David Macaulay (Houghton Mifflin)

Websites

www.energyquest.ca.gov

Homework & Family Connections

Encourage students to show their family how to make Machine toast. Each family member must draw a different type of machine, and label it as mechanical or electrical.

Little Orange Rooster

By Annette Van Wagenen

Once upon a time in a very sunny land, the Little Orange Rooster found a grain of wheat. He excitedly ran to his friends and asked, “Who will help me plant this wheat?”

“What happens when it is planted?” asked Misty Mouse.

“What good is a little thing like that?” questioned Puffy Pig.

“I love to dig in the dirt,” growled Doxie Dog.

So the Little Orange Rooster allowed Doxie Dog to dig a hole in the ground. Misty Mouse dropped in the grain seed. And Puffy Pig asked a lot of questions.

The Little Orange Rooster explained how the sun is the center of our solar system. Solar means “connected to the sun.” Our solar system is made up of the sun and everything circling around it. Without the sun’s energy, Earth would be completely dark and freezing cold. Living organisms use heat and light from the sun. Plants need sunlight to make their own food. Animals cannot make their own food. They must eat plants or other animals in order to live.

“Well, I want some food,” snapped Misty Mouse.

“It sounds like somebody’s going to have to work to get us some food,” said Puffy Pig.

“Let’s get digging,” suggested Doxie Dog.

The wheat seed was planted. Each day the four animals came out to watch the plant thrive in the summer sun. When it was large enough to harvest, the Little Orange Rooster asked, “Who will help me harvest the wheat?”

“What does it mean to harvest?” questioned Misty Mouse.

“I don’t think that sounds very fun!” stated Puffy Pig.

“Can I dig it up?” asked Doxie Dog.

So the Little Orange Rooster tried to explain about machines. “After crops are planted, there are many types of machines that help a plant get from the ground to the table.” Machines can be mechanical, electrical, or non-electrical. Mechanical machines can use burning fuel, human strength, flowing water, or even horsepower to provide energy. Electrical machines need electricity and usually plug into an electrical outlet or use batteries. We are going to take this grown wheat plant to the mill where it will be crushed and ground into flour.

So the four animals went off to Millie’s Mill to watch the wonderful machinery turn the grain into flour. When they brought the flour to the Little Orange Rooster’s house, he asked, “Who would like to help me make bread?”

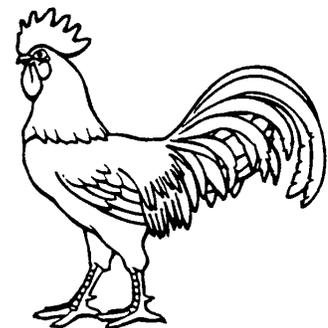
“How do you make bread?” wondered Misty Mouse.

“Is it fun to make bread?” asked Puffy Pig.

“Can I dig in the dough?” asked Doxie Dog.

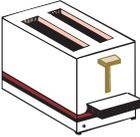
“Well,” said the rooster, “we can all help. We’ll use an eggbeater to beat one of my freshly laid eggs. Let’s open the new can of yeast with the electric can opener. Then we’ll mix in the bread machine the flour, salt, oil, sugar, and milk with the yeast and egg. We’ll bake it in the oven and use the electric knife to slice it when it is cool.”

It was a bit challenging to have four animals measuring and baking the bread, but when it was all done and out of the oven, it tasted wonderful.



Name: _____

Heat Sources

Mechanical 	Electrical 

Also Gives Off Light 	

Energy From the Sun

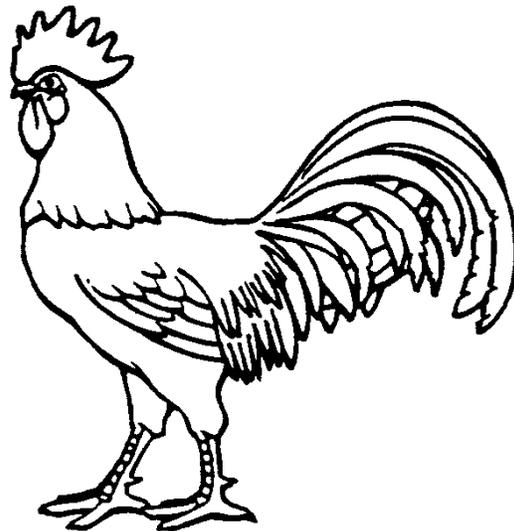


Word Box

sunlight
centerenergy
thingsfreezing
mechanicalfood
electrical

Little Orange Rooster explained how the sun is the _____ of our solar system. Without the sun's _____, Earth would be completely dark and _____ cold. Living _____ use heat and light from the sun. Plants need _____ to make their own food. Animals cannot make their own _____. They must eat other plants and animals to live.

After the Little Orange Rooster _____ the wheat, he took it to the flour mill where it was ground into flour. There they used a _____ machine, which used flowing water for energy, to crush the wheat. Then they went home and used an _____ machine, which was plugged in, to make the bread.



Activity—Heat from Machines

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 2

Demonstrate that mechanical and electrical machines produce heat and sometimes light.

Intended Learning Outcomes

1. Use science process and thinking skills
4. Communicate effectively using science language and reasoning

Standard

V

Objective

2

Connections

Background information

Heat energy can be produced by mechanical and electrical machines. Light can also sometimes be produced. Mechanical machines are those which do not use electricity, such as machines that use fuel (cars, lawn mowers), human strength (bikes, skateboards), or flowing water (water turbine). Classroom examples of mechanical machines include using scissors, a stapler, or a pencil sharpener. To use these machines, a student would provide the energy. So to measure the temperature difference, a student could measure the temperature of his/her hand before using the machine, and measure the temperature of the hand after using the machine for a minute or two.

Electrical machines include those which use electrical power and would have a plug or use batteries. Classroom examples include an overhead projector, electric pencil sharpener, computer, heat lamp, TV, or VCR.

Invitation to Learn

Review with students how mechanical and electrical machines can produce heat. Have students identify as many machines as possible in the classroom. Ask them how scientists would measure how much heat is produced. Scientists use measurements, so they would measure the temperature of the machines before it is turned on, and after it has been turned on for a while.

Instructional Procedures

Materials

- 4 thermometers
- Heat worksheet
- Classroom machines: projector, electric pencil sharpener, heat lamp, toaster, computer, manual pencil sharpener, scissors and paper, etc.

1. Divide students into four groups.
2. Students will fill out the worksheet by predicting which machines will produce measurable heat.
3. Decide as a class which four machines will be tested, and assign a group to measure the temperature before and after being turned on. Decide as a class how long the temperature will be measured, and how it will be measured.
4. Students should check thermometers before to see that they all measure the same temperature. Then they will record the temperature of the machine before being used. (For accuracy, the experiment could be repeated several times and the results averaged).
5. If the machine being used is a mechanical one, with the energy being provided by the student, you could measure the temperature of the student before and after using the machine.
6. Students complete the worksheet for their machine, then write in the information from the other groups. The temperatures will be drawn in and graphed on the second part of the worksheet.

Curriculum Integration

Math/Science

3rd Grade Math, Standard IV, Objective 2g: Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer.

Standard V, Objective 1: Collect, read, represent, and interpret data using tables, graphs, and charts. Make predictions based on a data display.

Possible Extensions/Adaptations

Students may measure the heat difference on other machines in the school or at home.

For mechanical machines being powered by the student, the temperature difference could be found using a heat sensitive liquid crystal sheet (thermal heat sensor), and watching how long it takes to see the fingerprints before using the machine and after using it.

Assessment Suggestion

Grading student worksheet:

- 10 points correct, complete, detailed
- 8 points partially correct, complete, detailed
- 6 points partially correct, partially complete, lacks some detail
- 5-1 points incorrect or incomplete, missing data, needs help

Additional Resources

Dorling Kindersley Eyewitness Books: Electricity by Steve Parker

Dorling Kindersley Eyewitness Books: Energy by Steve Parker

www.energyquest.ca.gov/index.html (This is a great website and includes interactions for students, parents, and teachers.)

www.sciencenetlinks.com (search for links on heat)

Homework & Family Connections

Students may check out a Temperature Backpack to complete experiments at home.

Name: _____

Heat From Machines

Question: Which machines will produce heat?

Hypothesis: _____

Experiment: Try some mechanical and electrical machines to see which produce heat.

	Machine	Elec.	Mech.	Heat?	Off	On	Difference
1.							
2.							
3.							
4.							

Conclusion: I found out that _____

Discovery: The most interesting thing I observed _____

Temperature Tracking

1. Off On	2. Off On	3. Off On	4. Off On
Difference _____	Difference _____	Difference _____	Difference _____

°F	Off	On	Off	On	Off	On	Off	On
150°								
140°								
130°								
120°								
110°								
100°								
90°								
80°								
70°								
60°								
50°								
40°								
30°								
20°								
10°								
0°								

Activity—Rubbing Objects Together

Standard
V

Objective
2

Connections

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.

Objectives 3

Demonstrate that heat may be produced when objects are rubbed against on another.

Intended Learning Outcomes

1. Use science process and thinking skills
4. Communicate effectively using science language and reasoning

Teacher Background

When objects are rubbed against one another, heat may be produced. When hands are rubbed together, the resulting heat will vary depending on how dry the hands are. The amount of moisture, perspiration, and/or oil on the skin will vary. You will observe that hands with recently applied lotion warm up less quickly.

Invitation to Learn

Review what it was like to be in a dark, cold cave. What was the best way to keep your hands warm?

Instructional Procedures

1. Predict what will happen when you rub hands together vigorously.
2. Rub your hands together. Do your hands feel warmer?
3. Rub your hands together again only faster and longer. Put your hands on your face. How do your hands feel? Run water on your hands and see if it rubs the same. Now add lotion to dry hands and rub them again. Do your feel a difference in the amount of heat?
4. Show a piece of equipment like a sewing machine. Put a drop of oil where it needs lubrication. Tell the students that maintenance workers in large factories use oil to reduce the rubbing of machinery. This cuts down on wear and tear of the machine by reducing heat.
5. Predict what will happen when you rub sand paper on a tongue depressor.

The sand paper in your hand, and the hand holding it, will become warm. Have one or two students touch the heat sensor

Materials

- Lotion
- Squiggly eyes
- Sandpaper
- Balloons
- Tongue depressors
- Heat sensor
- Orange and yellow construction paper
- A machine with lubrication oil

with their hands until it changes color. Time how long it took. Then have them try to rub the sandpaper with their hands for a minute, then try the heat sensor again. Now how long did it take? Was it quicker? Have all students rub with sandpaper, then put their hands on their faces. Can they feel the difference in temperature on their faces?

6. Feel a paper clip. Then rub it vigorously on the rug a minute. Feel it again.
7. Blow up two balloons. Rub them together until one of them pops.
8. Fill out worksheet by drawing in six examples of creating heat by rubbing.

Curriculum Integration

Language Arts—Write collaboratively and respond to the writings of others.

Possible Extensions

Find other things to rub sand paper on. Try cloth, wood blocks, and metal. Does it have the same effect as when rubbed on the tongue depressor? Turn the tongue depressor into a sunshine by cutting a sun shape out of yellow construction paper. Then glue on squiggly eyes and draw a mouth.

Divide the class into groups and brainstorm a list of examples of heat being produced when objects rub together. Combine these lists into a class list. Assign student pairs to write mini-reports on these heat producers and combine these into a class booklet.

Assign students to create a cartoon strip with conversation bubbles, explaining an activity they have just completed. Have them get into groups and share their writings.

Assessment Suggestions

Check student's worksheet for understanding of objective.

Additional Resources

Books

Science for Fun-Experiments by Gary Gibson (Copper Beech Books)
The Magic School Bus Plays Ball: A Book About Forces and Friction

Videos

Magic School Bus Plays Ball, VH. Catalog Number 14335

Websites

<http://www.scholastic.com/magicschoolbus/games/teacher/forces/index.htm>

Homework and Family Connections

Look around the house for machines that need lubrication. Ask parents when was the last time the car was taken in for an oil change. A visit to a flourmill would be an informative field trip. While there, ask the manager for information about the frequency that machinery needs oiling.

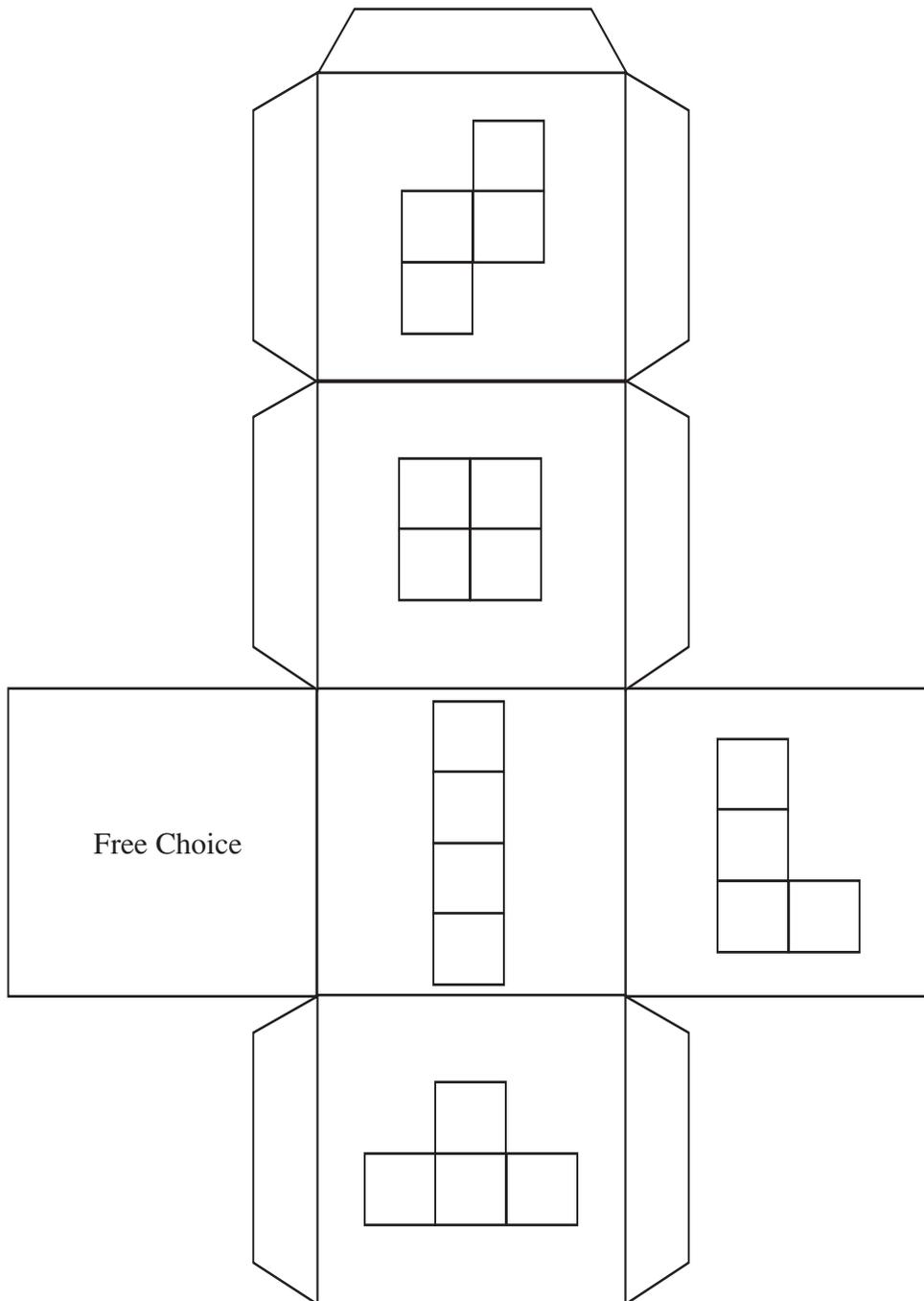
Name: _____

Heat with Rubbing

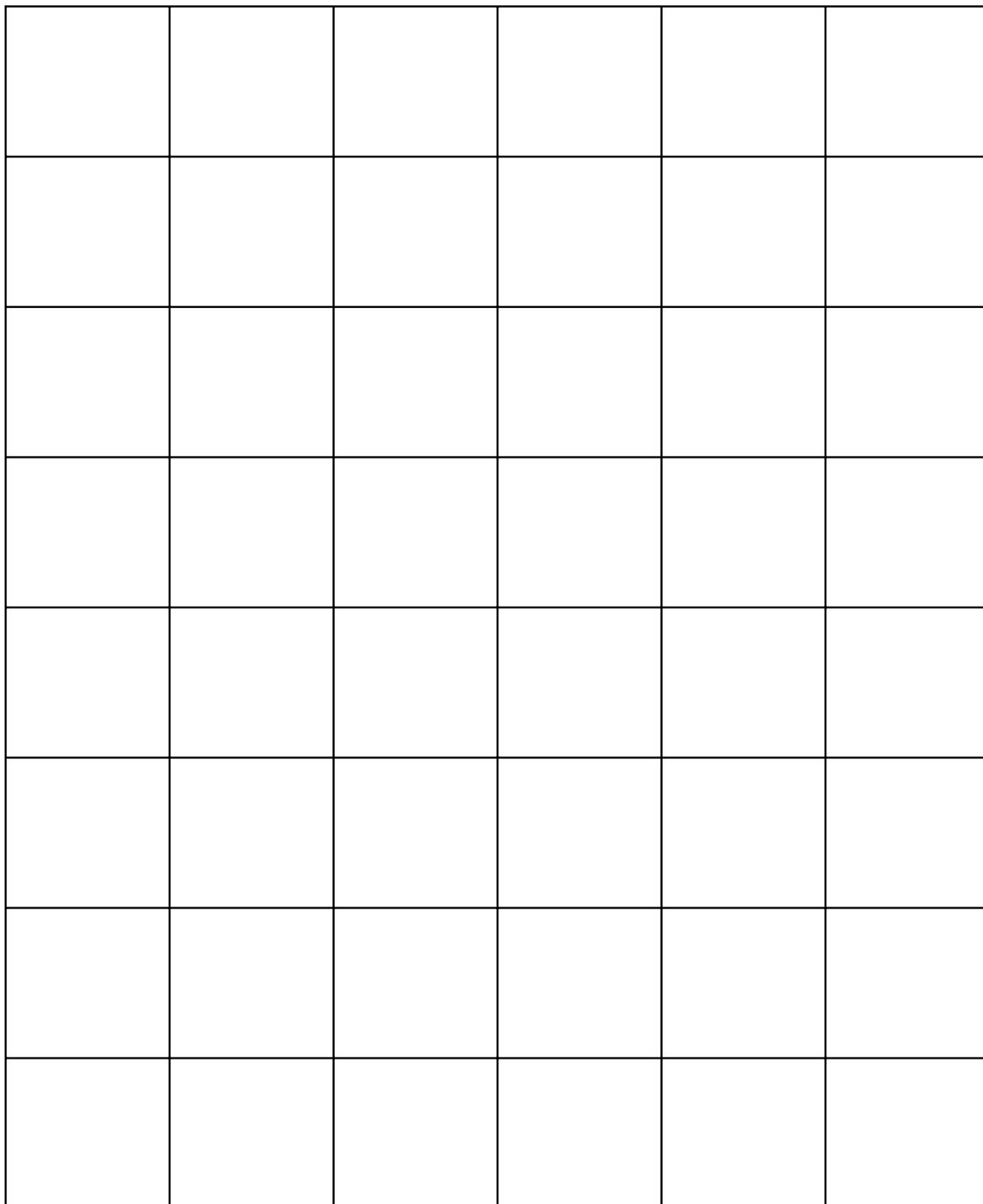
Draw 6 examples

Appendix

Tetrominoes Die



Tetrominoes Cover-Up Game Board



Inquiry Data Sheet

The question: How does the height of the inclined plane affect the distance a marble or other round object will roll?

We predict (our hypothesis is):

The materials we used:

The steps we followed (our procedure is):

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

The observations we made (my data are):

The answer to the question (our conclusion is):

Multiple Choice Assessment Item

Directions

Use the box of minerals labeled A, B, C, and D, and the hand lens to help you answer the following question.

Stem

On which of the following minerals can you make a visible scratch mark with your fingernail?

Options

- A. fluorite
- B. gypsum
- C. quartz
- D. calcite

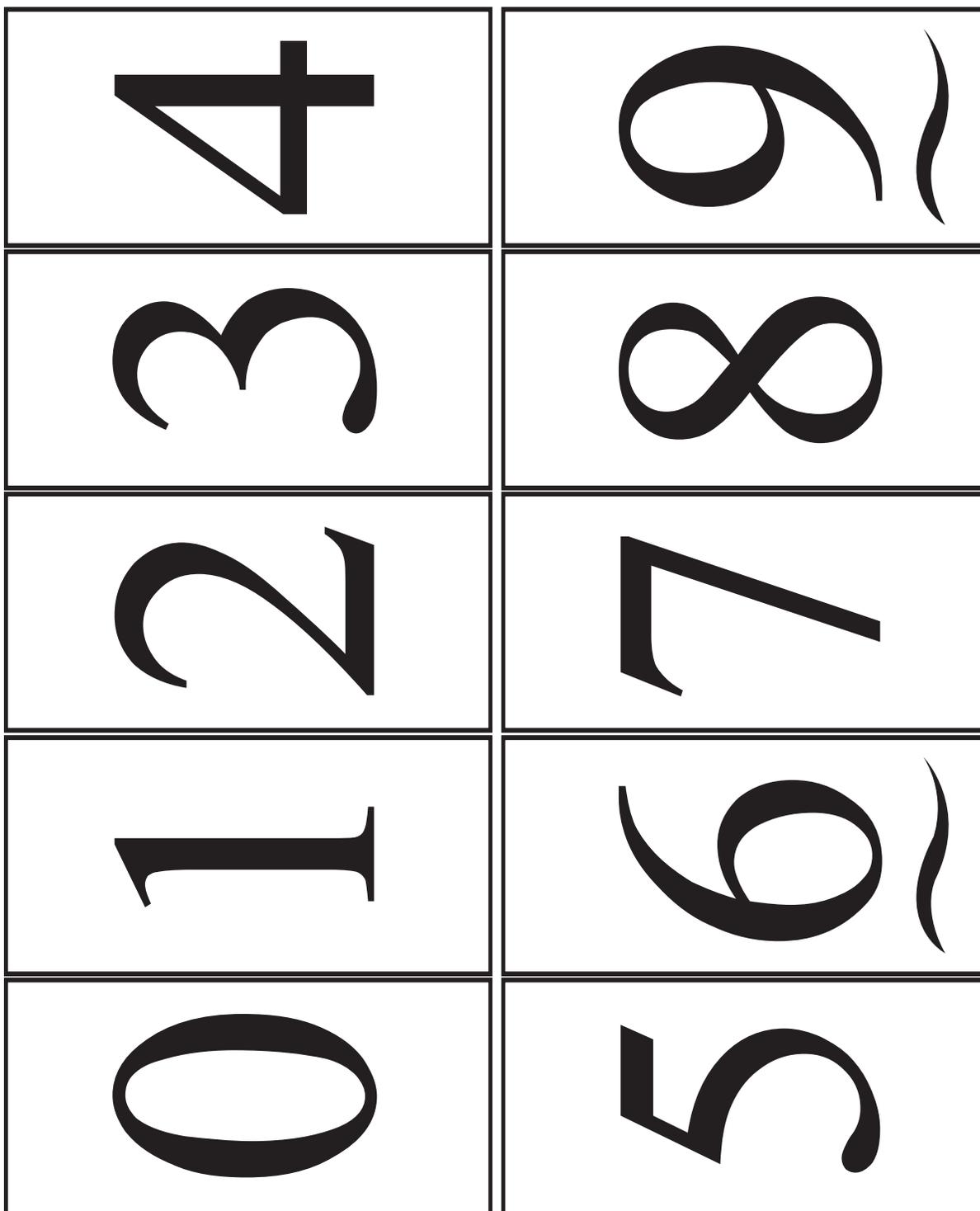
Scoring Key

- B. gypsum

Rationale

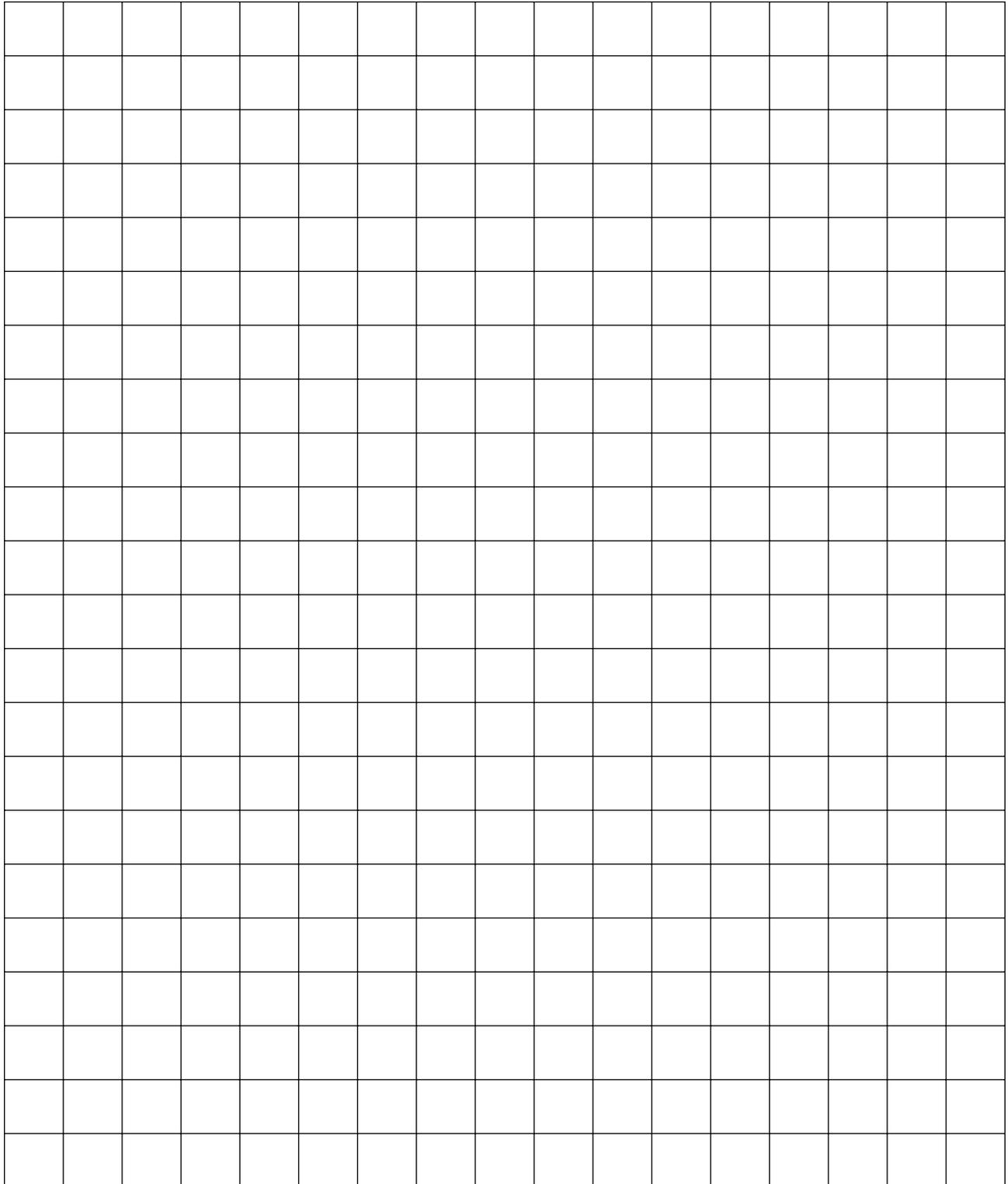
Students are to categorize rocks and minerals according to observed properties, which include hardness. This question employs the process of investigation by performing a scientific behavior and evaluating the results.

Salute Cards



Standard 1: Number and Operation ***Multiplication Arrays***

Procedure: Read the story and have students create arrays of numbers in various ways.



Name: _____

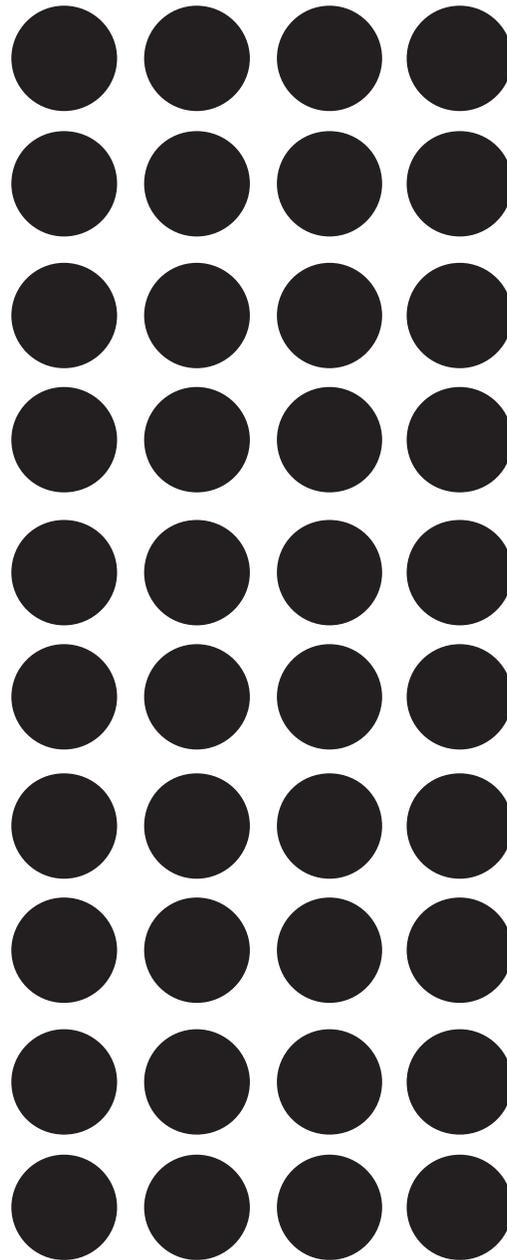
Fact Power Table/Dot Array Sheet

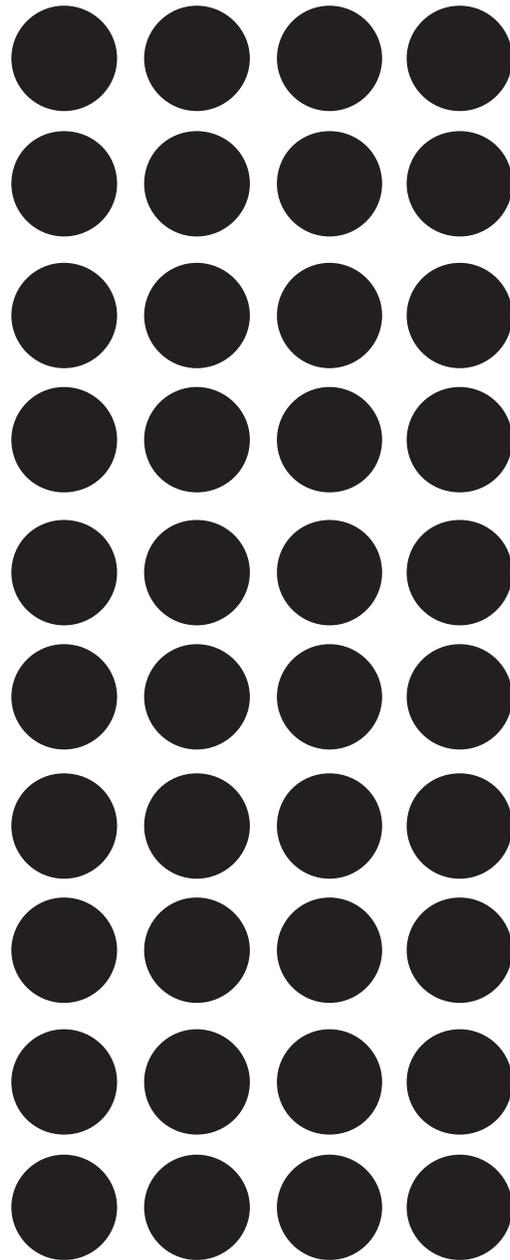
Draw an array for each multiplication fact in the table. Write the product.

X; ÷	1 ·	2 ..	3 ...	4	5	6	7	8	9	10
1 ·										
2 · ·										
3 · · ·										
4 · · · ·										
5 · · · · ·										
6 · · · · · ·										
7 · · · · · · ·										

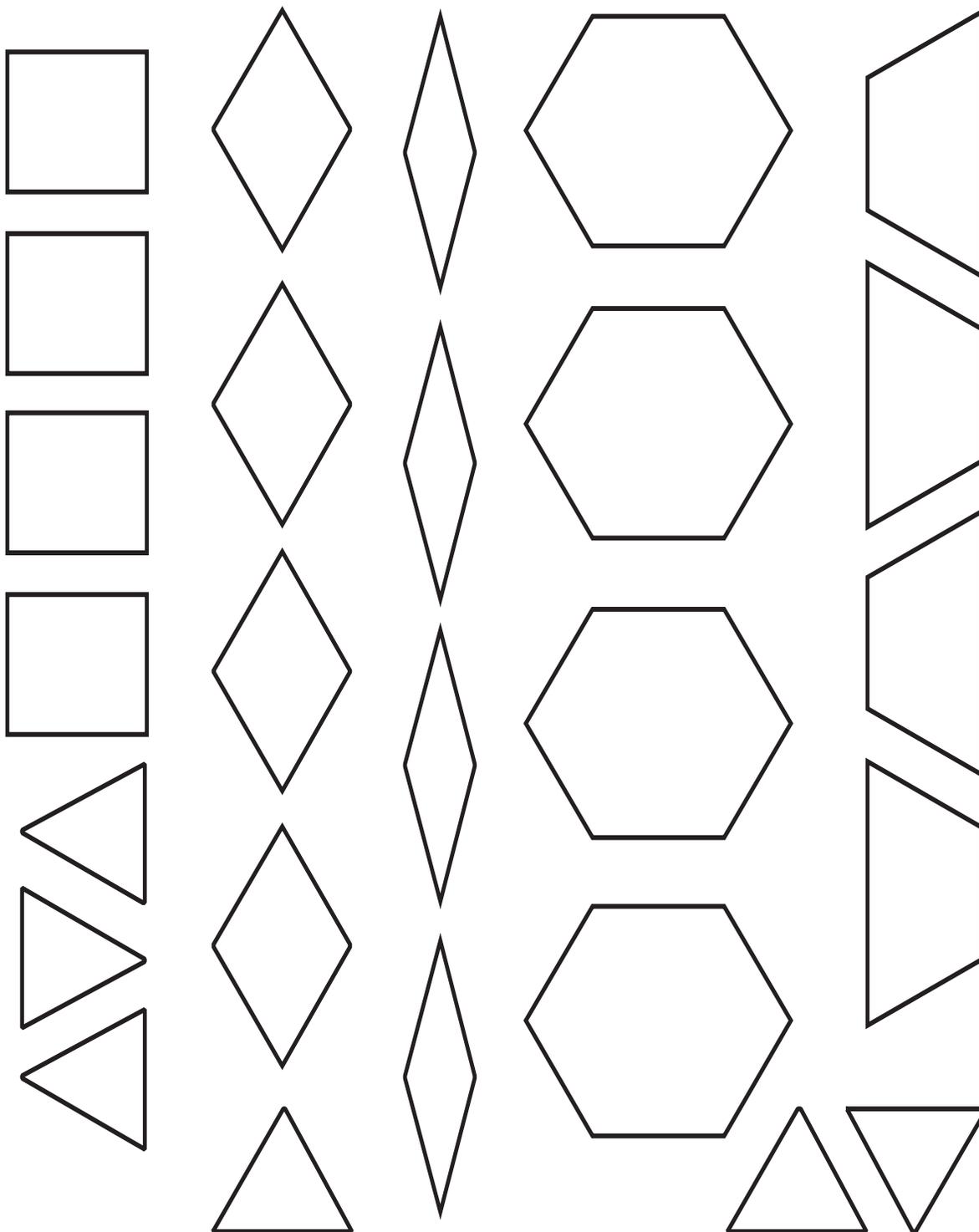
8										
9										
10										

Dot Sheets



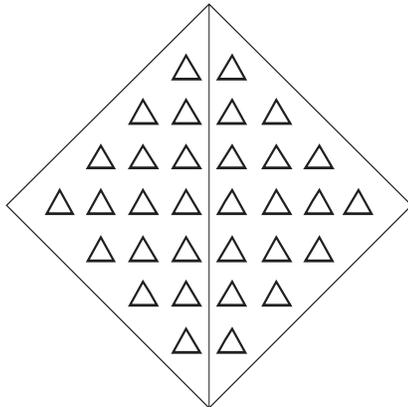


Pattern Blocks



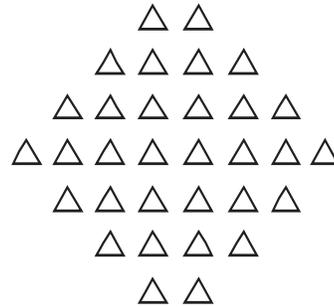
Pattern Search

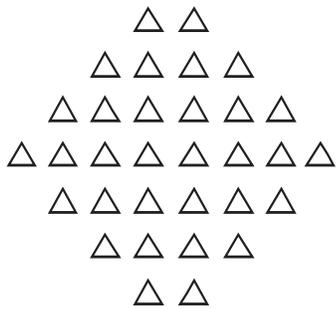
Find as many different ways as you can to partition the array of triangles below. Record each way as a numerical equation.

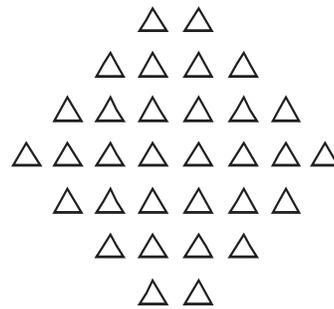


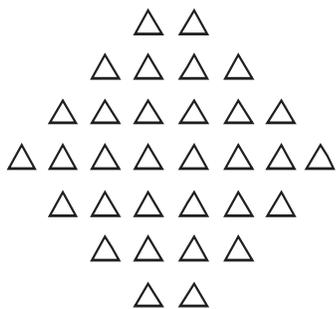
$$\underline{16+16=32}$$

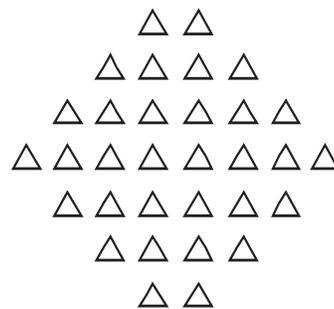
$$\underline{2 \times 16 = 32}$$

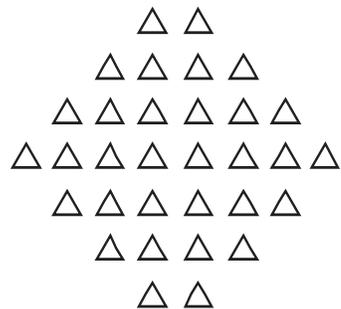
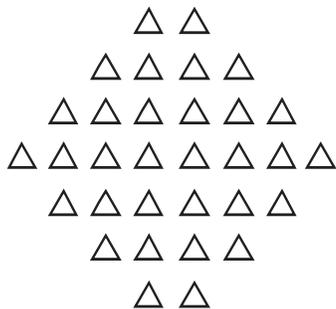
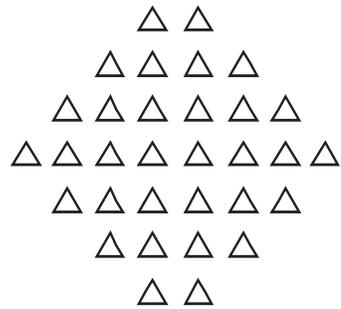
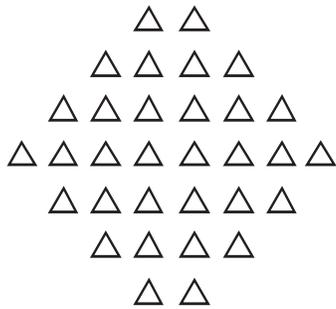
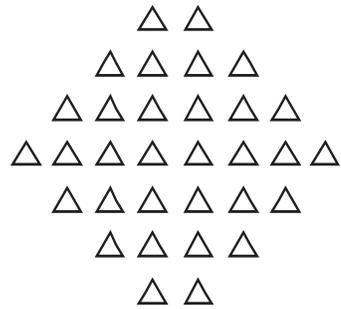
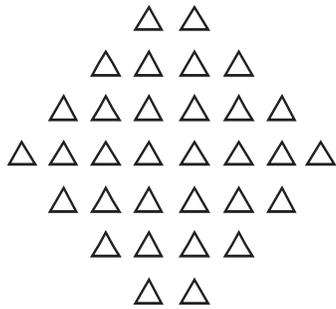




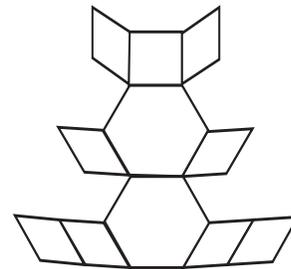
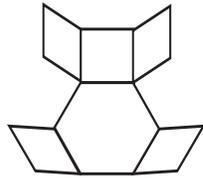








Demonstration Critters



Square 	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____

Blue Rhombus 	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____

Hexagon 	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____

Total	
Terms	Tiles
1	
2	
3	
7 (Predict)	

Pattern _____

Multiplication Chart

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Recording Sheet

Height of Tube	Distance the Object Rolled
0 cm	
5 cm	
10 cm	
___ cm	
___ cm	
___ cm	
___ cm	

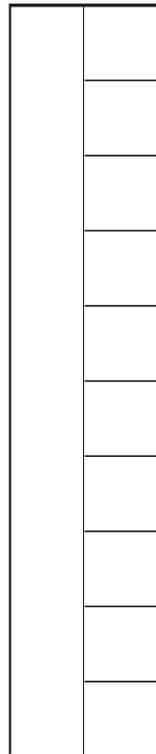
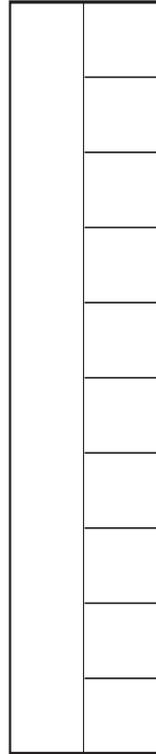
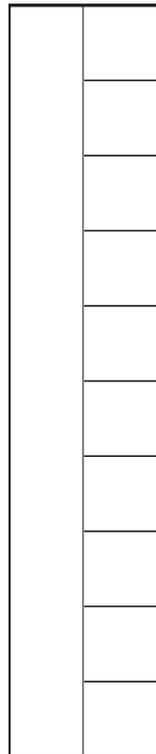
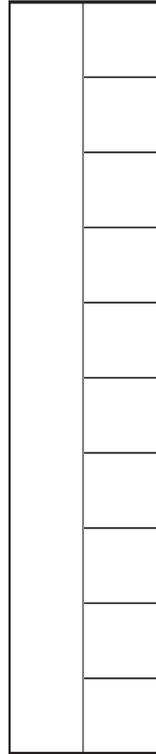
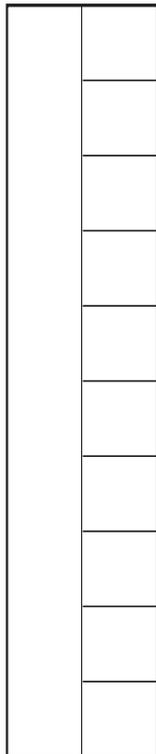
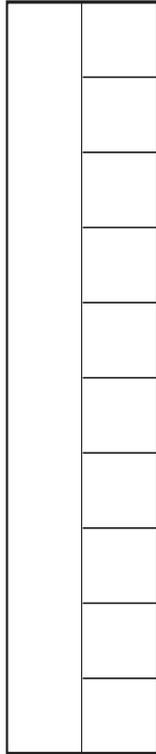
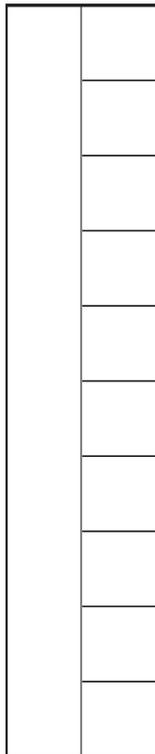
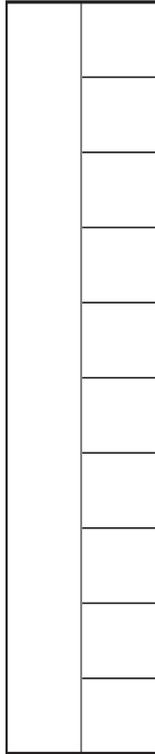
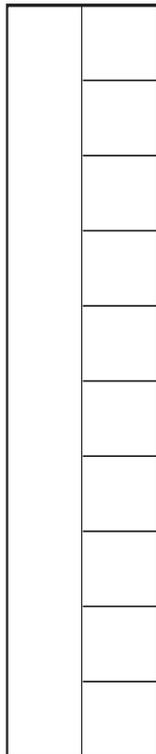
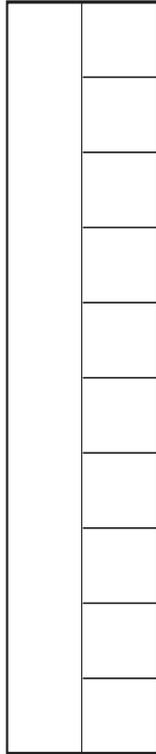
1. Which height do you predict will cause the marble to roll the longest distance?
2. Was your prediction correct? _____ What is your reasoning?
3. Would a larger marble roll farther? _____ Trade your original marble for the larger marble and try a few rolls to test your prediction.
4. What happened to the marble when you placed the tube on the ruler mark “0” or “25”? Why do you suppose?
5. Does the surface of the floor make a difference? (e.g. cement, carpet, tile, dirt, etc.)
6. Does the surface of the ball make a difference? (clay compared to metal)
7. Think of a question that can be answered with this experiment.

Metric Tape Measure I

Cut each rectangle down the center of the bold lines. Tape rectangles together to create a meter tape. Label the meter tape as shown in the example.

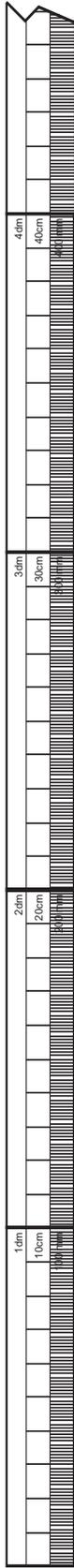


Adapted from Gayle Cloke

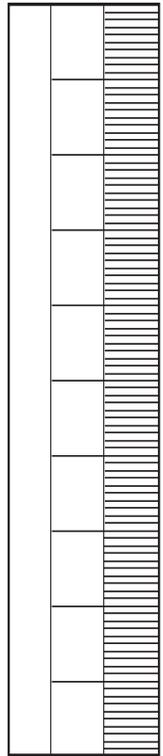
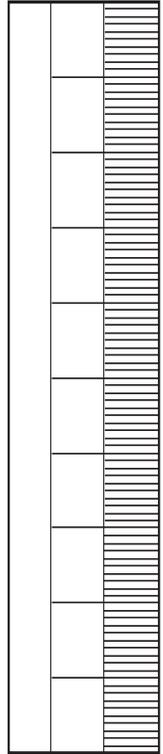
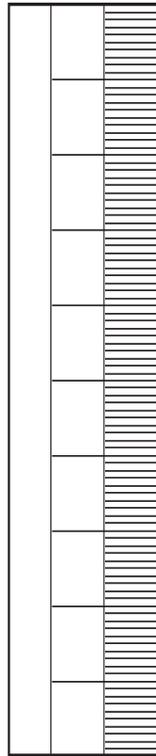
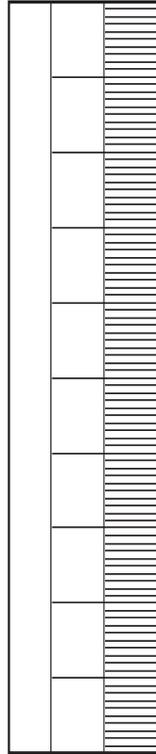
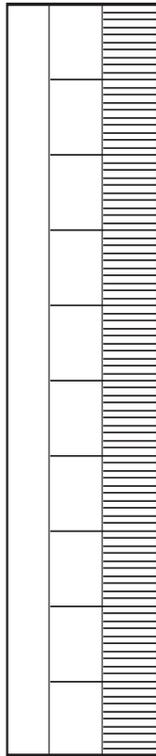
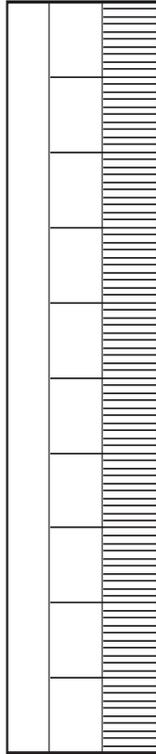
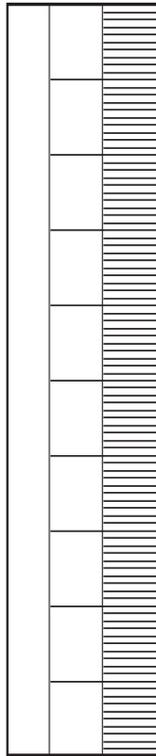
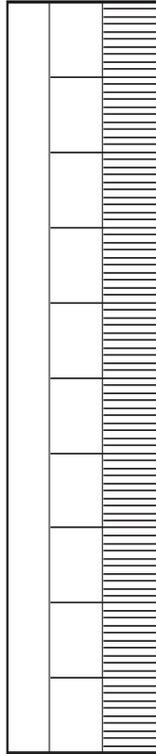
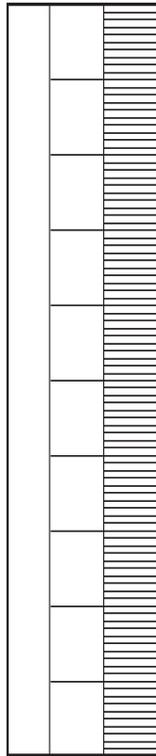
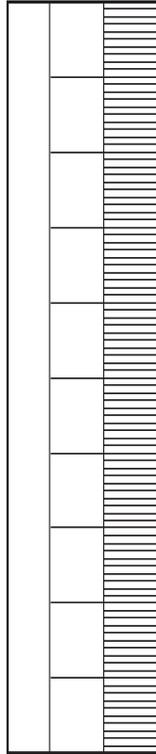


Metric Tape Measure 2

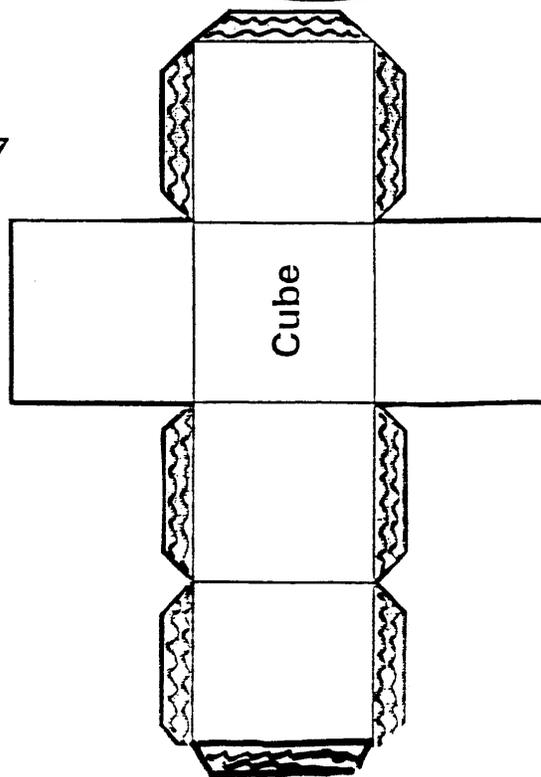
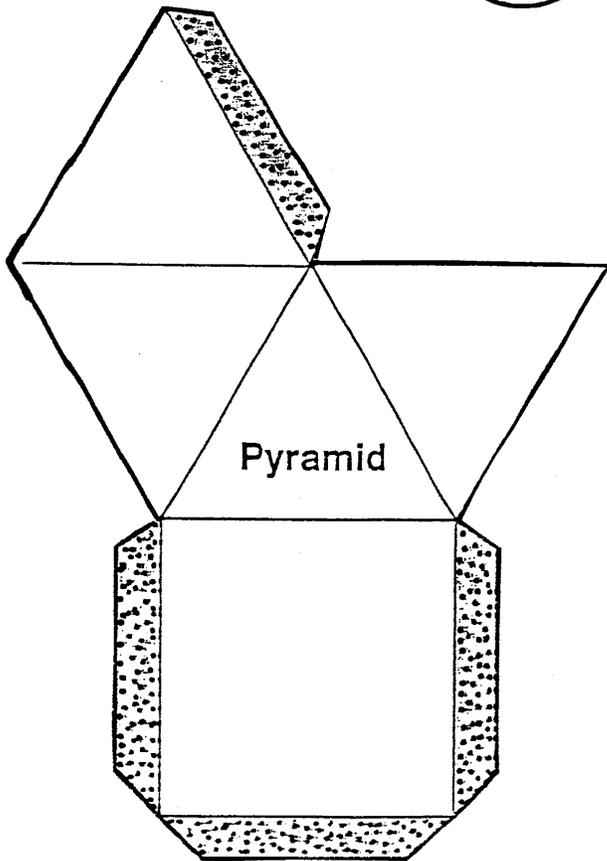
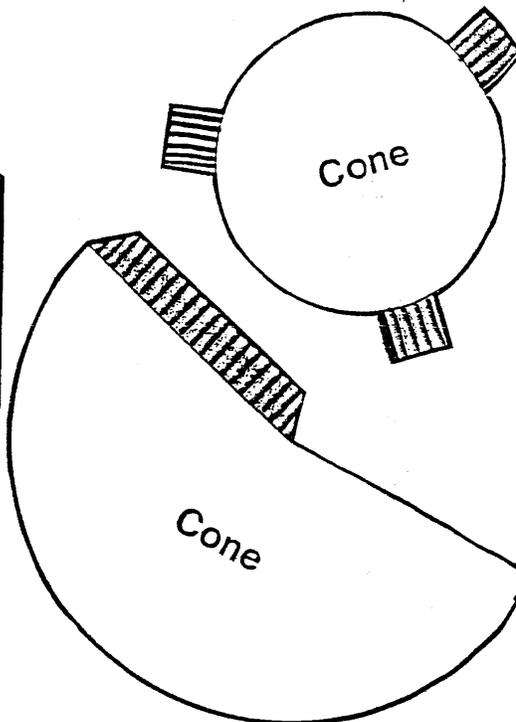
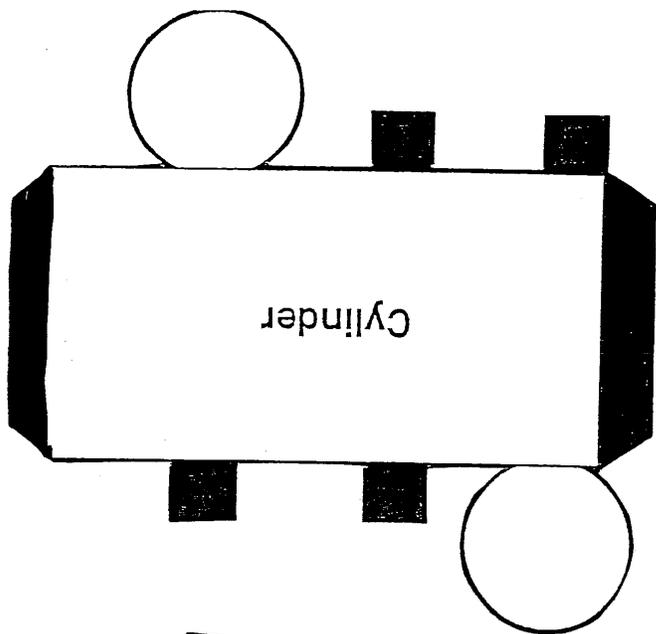
Cut each rectangle down the center of the bold lines. Tape rectangles together to create a meter tape. Label the meter tape as shown in the example.

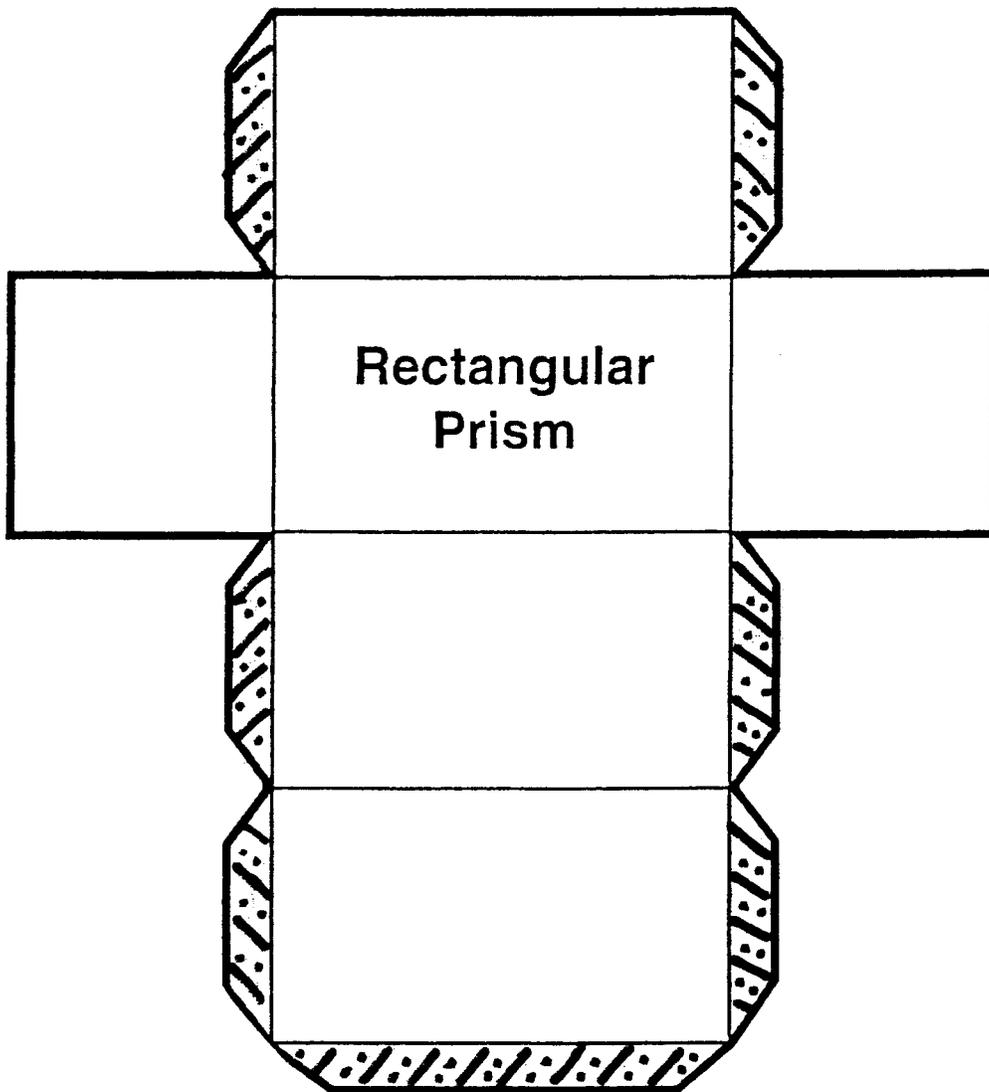


Adapted from Gayle Cloke

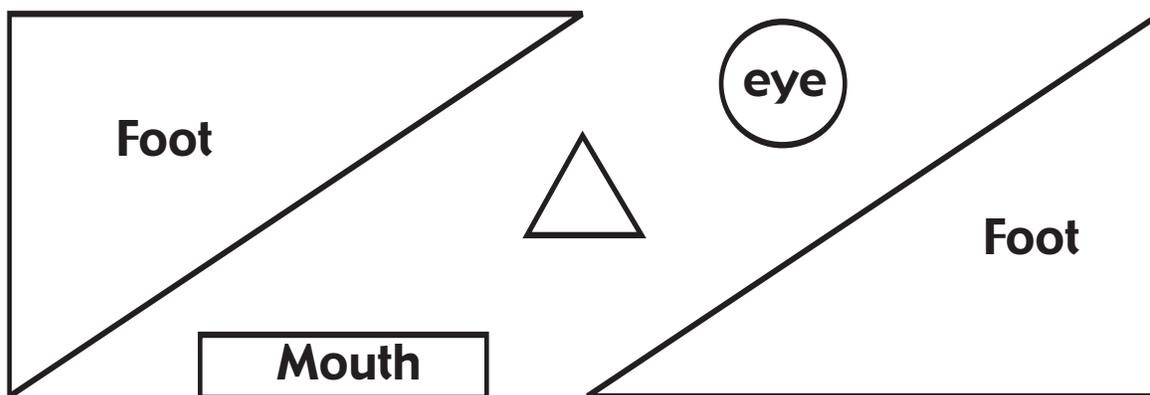
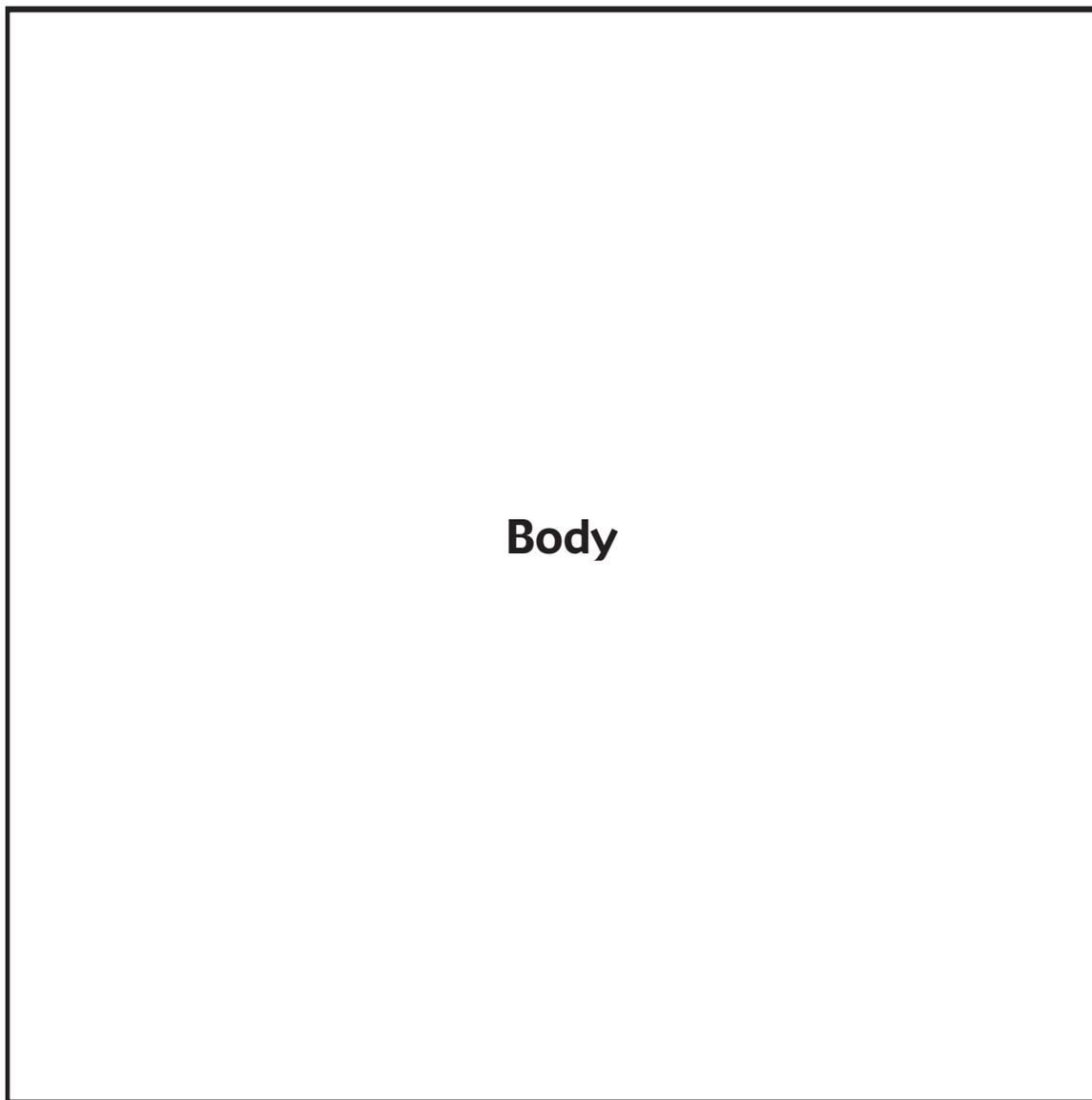


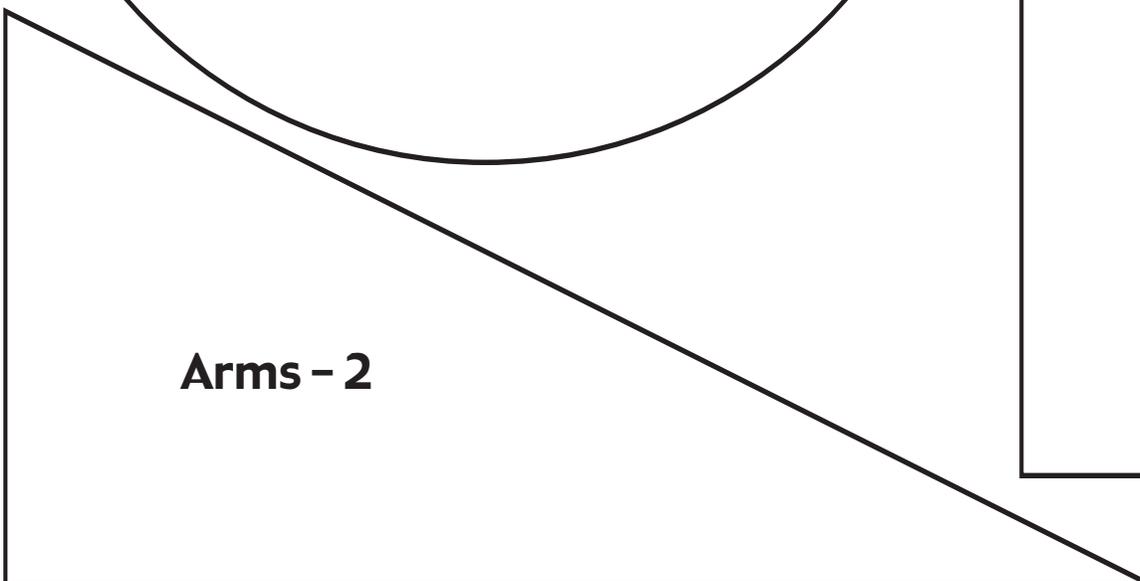
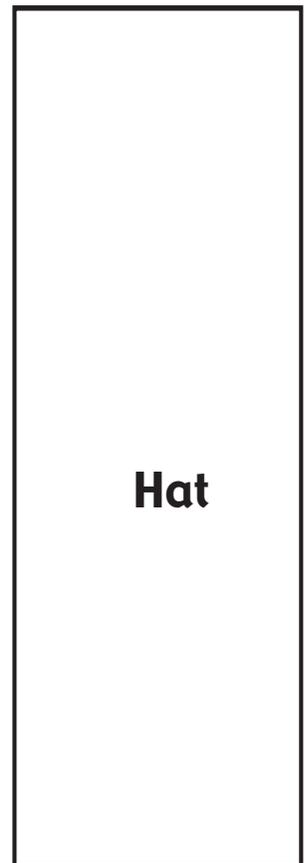
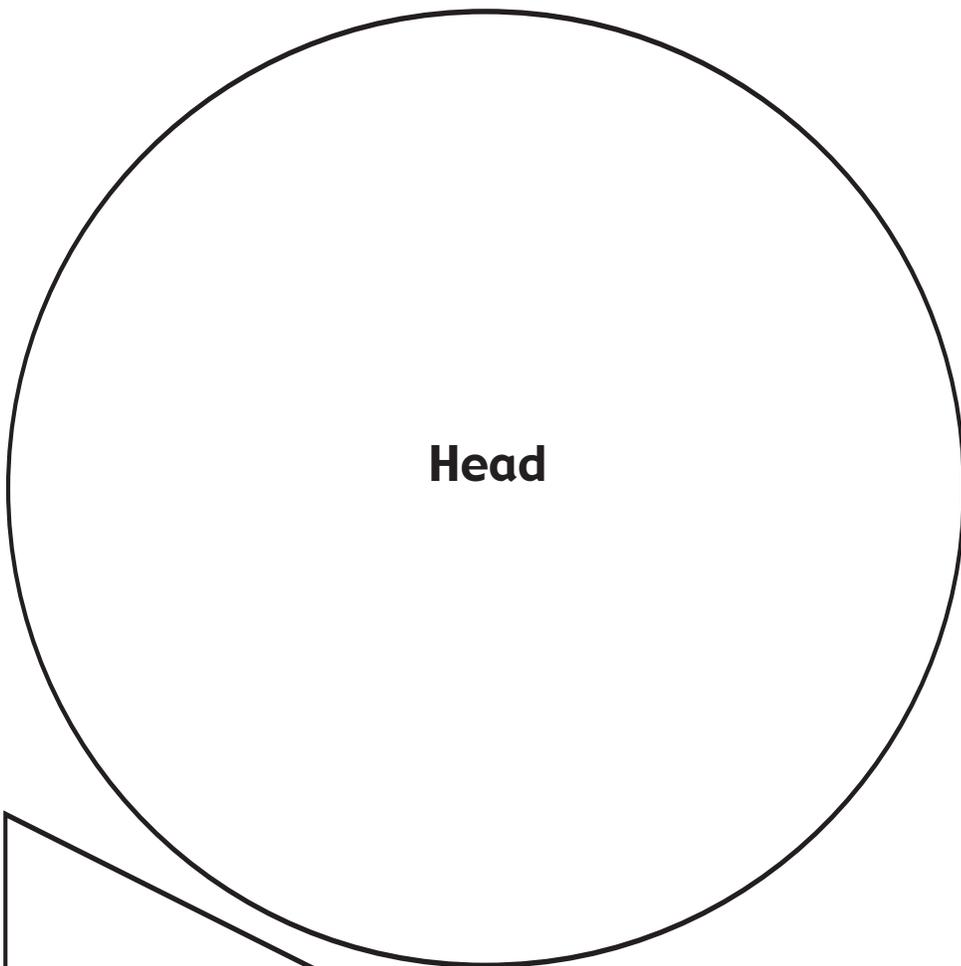
Construction Squares





Who Says I'm Square? Body Parts





Name: _____

Geometric Addition



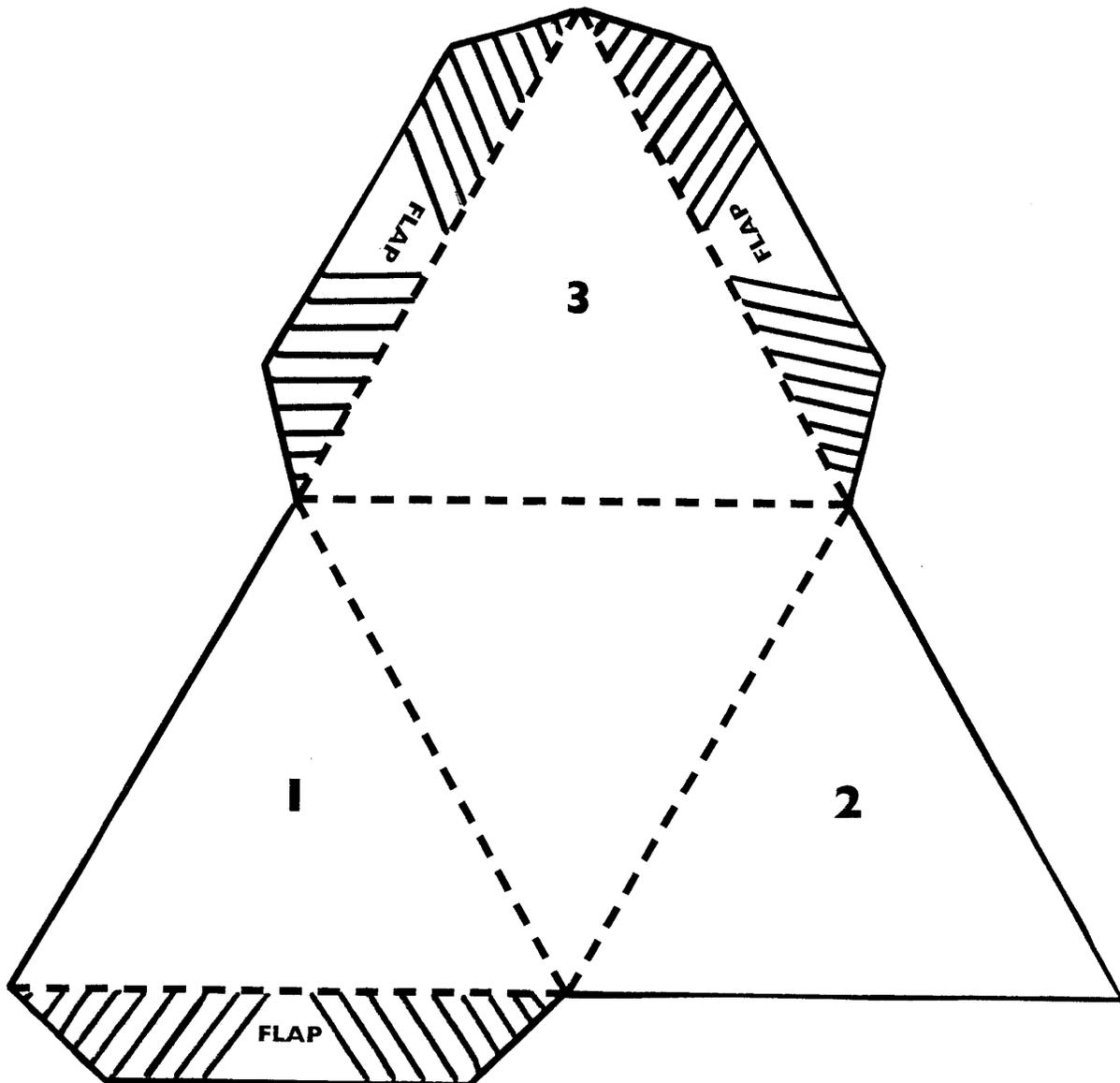
1. One triangle has how many sides?
2. One square has how many sides?
3. One circle has how many sides?
4. 1 square + 1 triangle has how many sides total?
5. 1 triangle + 1 circle has how many sides total?
6. 3 triangles have how many sides in total?
7. 10 triangles have how many sides in total?
8. 5 squares have how many sides in total?
9. 10 circles have how many sides in total?
10. 2 triangles + 2 squares + 2 circles have how many sides in total?

Egyptian Treat Boxes (Pyramid)

What you need:

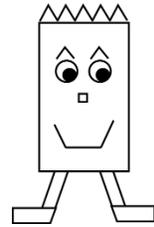
- Pyramid Gift Box Pattern for each student (below)
- Construction paper or any other type of heavy decorative paper
- scissors
- glue or tape

These fun boxes are perfect for holding small treats!



Name: _____

ABC Symmetry



On the chart, write the letters of the alphabet in the right column.

Letters with No Lines of Symmetry	Letters with Onw Line of Symmetry	Letters with Two Lines of Symmetry	Letters with More Than Two Lines of Symmetry

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

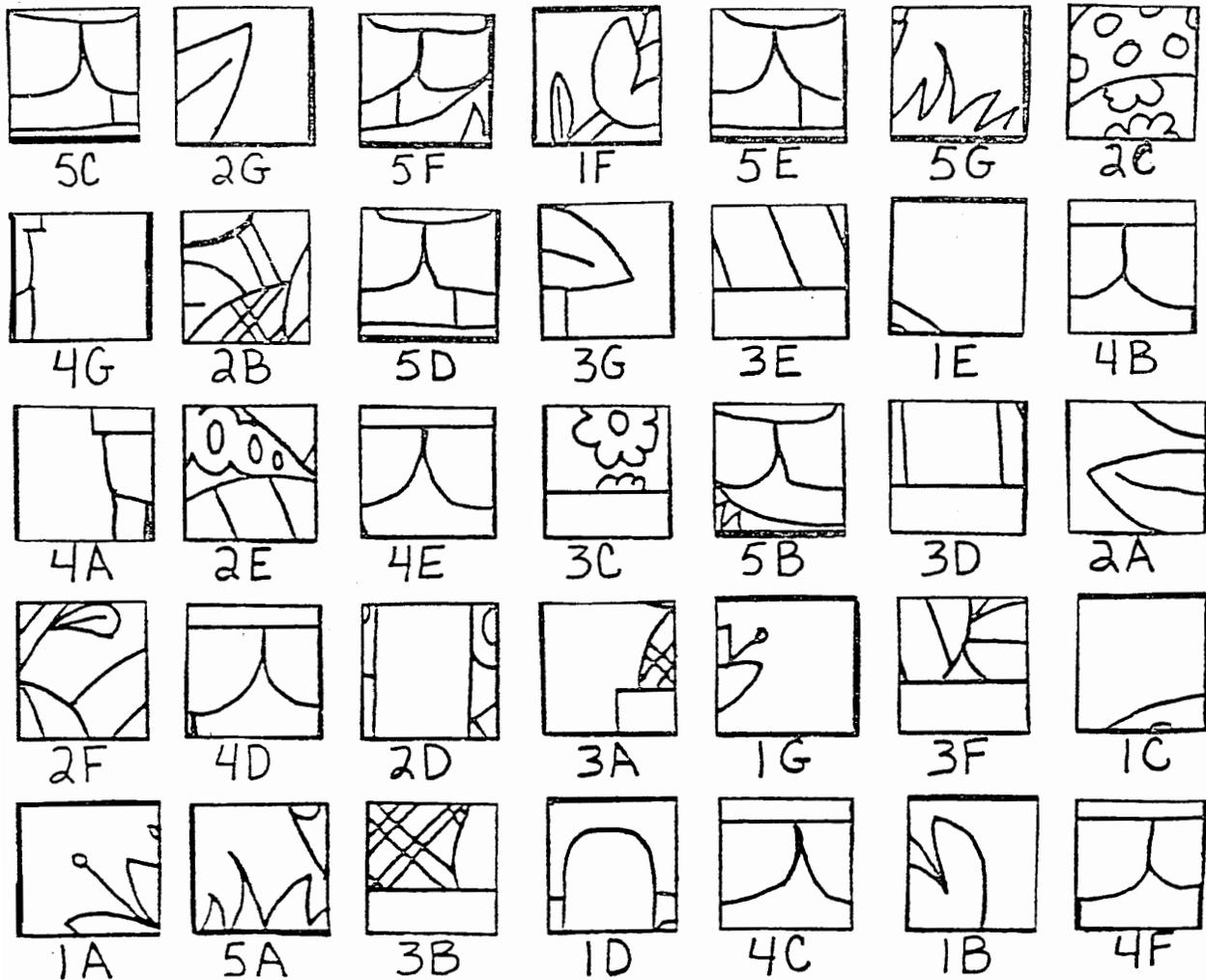
X

Y

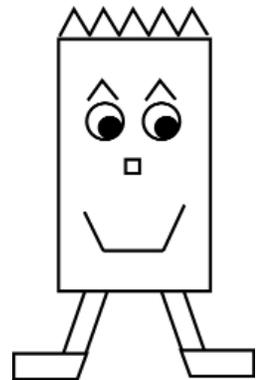
Z

Spring Time Art

Each square contains one part of a complete picture. Copy each square into the empty square with the same number. When you have drawn in each square, all the squares together will make a picture for Easter.



	A	B	C	D	E	F	G
1							
2							
3							
4							
5							



Name: _____

Jelly Bean Math



Estimate how many jelly beans are in your baggy _____

Colors	Estimate	Tallies	Coordinates
Red			
Yellow			
Green			
Purple			
Black			
Orange			

Jelly Beans

Answer the following:

Total number of jelly beans in your baggy? _____

Which color of jelly beans do you have the most of? _____

Which color do you have the least of? _____

What is the difference between the two? _____





Jelly Bean Fun

Use your jelly beans to show sets of tens and ones.

Red	tens _____	ones _____	Purple	tens _____	ones _____
Yellow	tens _____	ones _____	Black	tens _____	ones _____
Green	tens _____	ones _____	Orange	tens _____	ones _____

Make and then draw a pattern with two colors of Jelly Beans.

Make and then draw a pattern with three or more colors of Jelly Beans.

Compare your numbers using a < or > or = sign.

- | | |
|-----------------------|------------------------|
| 1. yellow _____ green | 4. orange _____ red |
| 2. red _____ orange | 5. purple _____ green |
| 3. green _____ black | 6. yellow _____ purple |

Fill in complete the following addition problems:

- | | |
|---------------------------------------|---------------------------------------|
| 1. yellow _____ + green _____ = _____ | 4. red _____ + green _____ = _____ |
| 2. red _____ + orange _____ = _____ | 5. orange _____ + green _____ = _____ |
| 3. black _____ + purple _____ = _____ | 6. yellow _____ + black _____ = _____ |

Key Moon Book Moon Words

appearance

axis

model

moon

orbit

revolution

rotation

sphere

How are the moon and earth **alike**?

Moon

Earth

What do you **think** the moon is made of?

Do you **think** there is anything on the moon?

How are the moon and earth **different**?

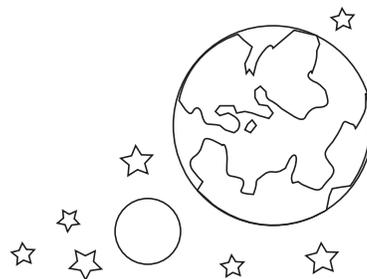
Moon

Earth

What do you **think** there is?

The moon is really made of what?

Draw a picture of what is on the moon.



How do you **think** we get day and night? Why does the moon change shape?



Tell how we get day and night. Draw a picture. The moon changes shape because...

Where do you **think** the moon gets its light from?

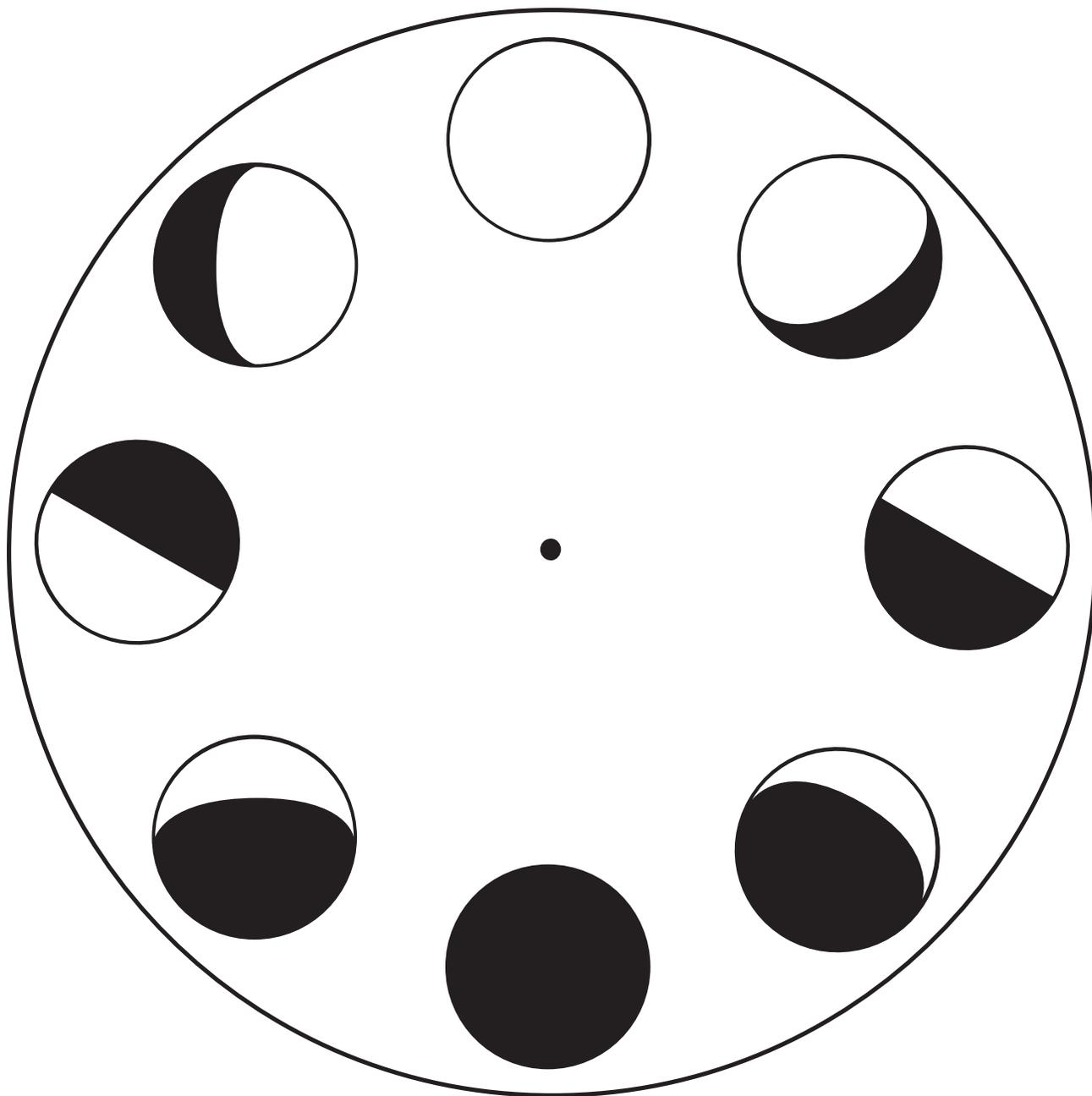
Who do you **think** we see different star patterns in the night sky?

Draw how the moon gets its light.

We see different patterns in the night sky because...

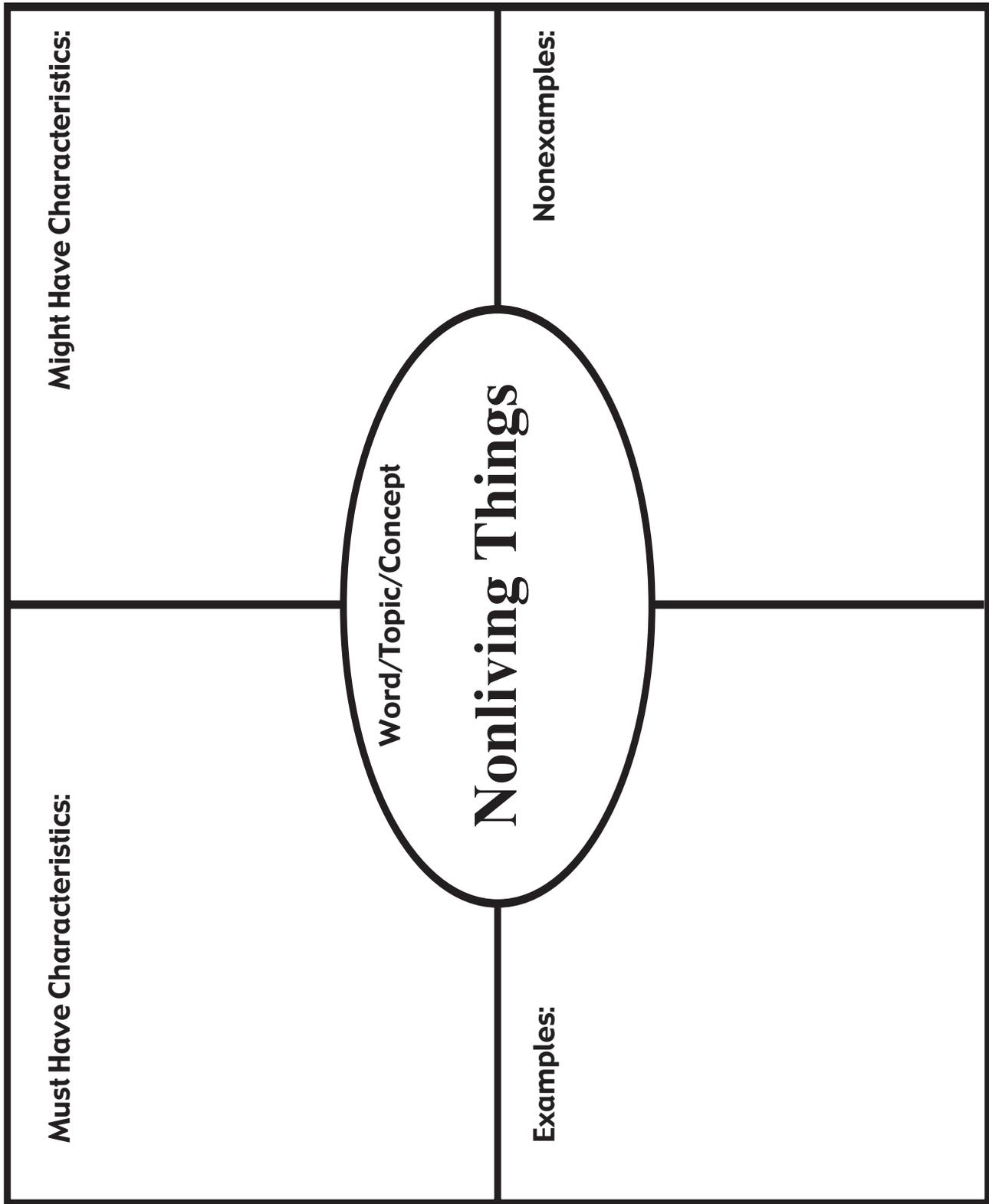


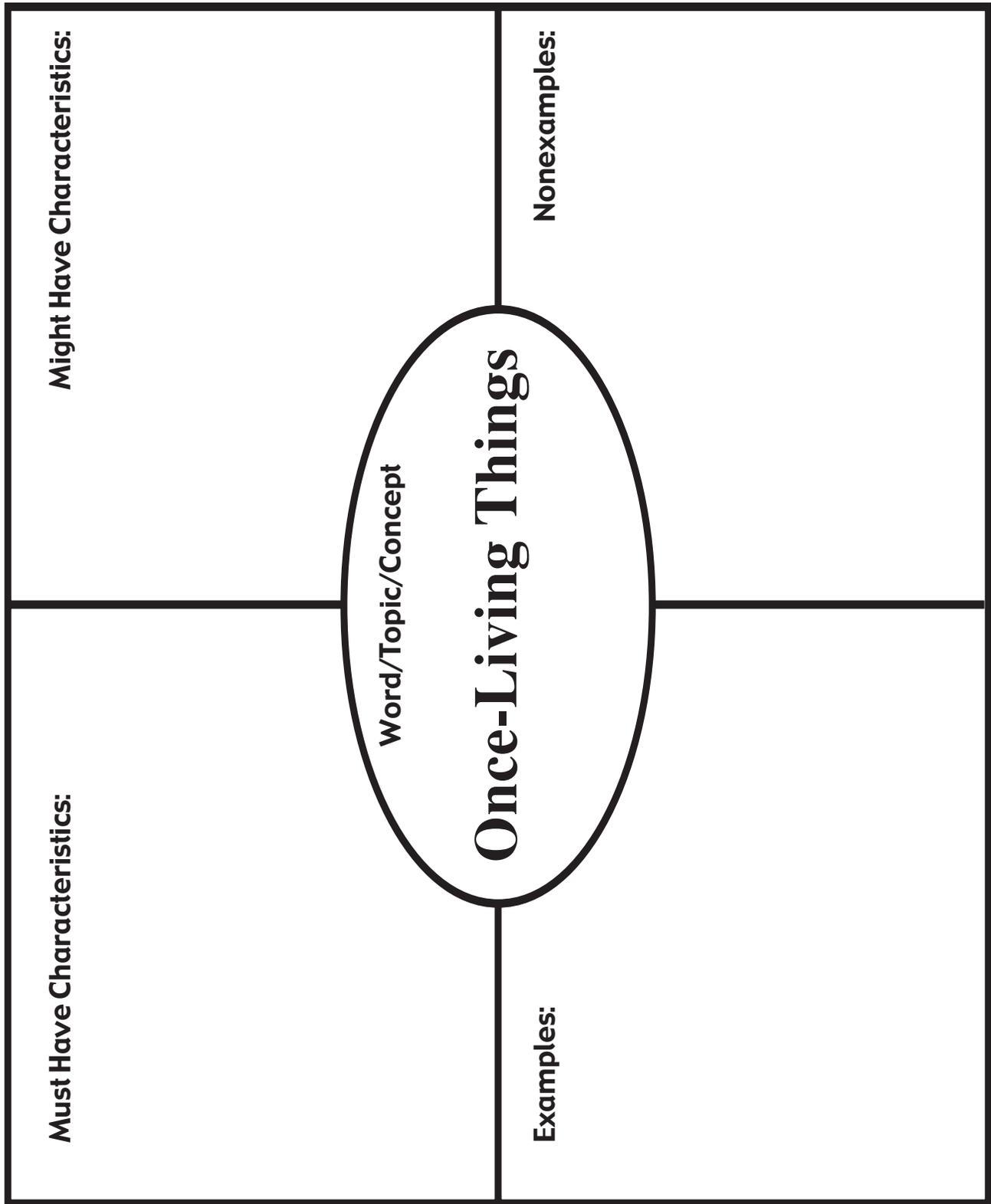
Moon Spinner

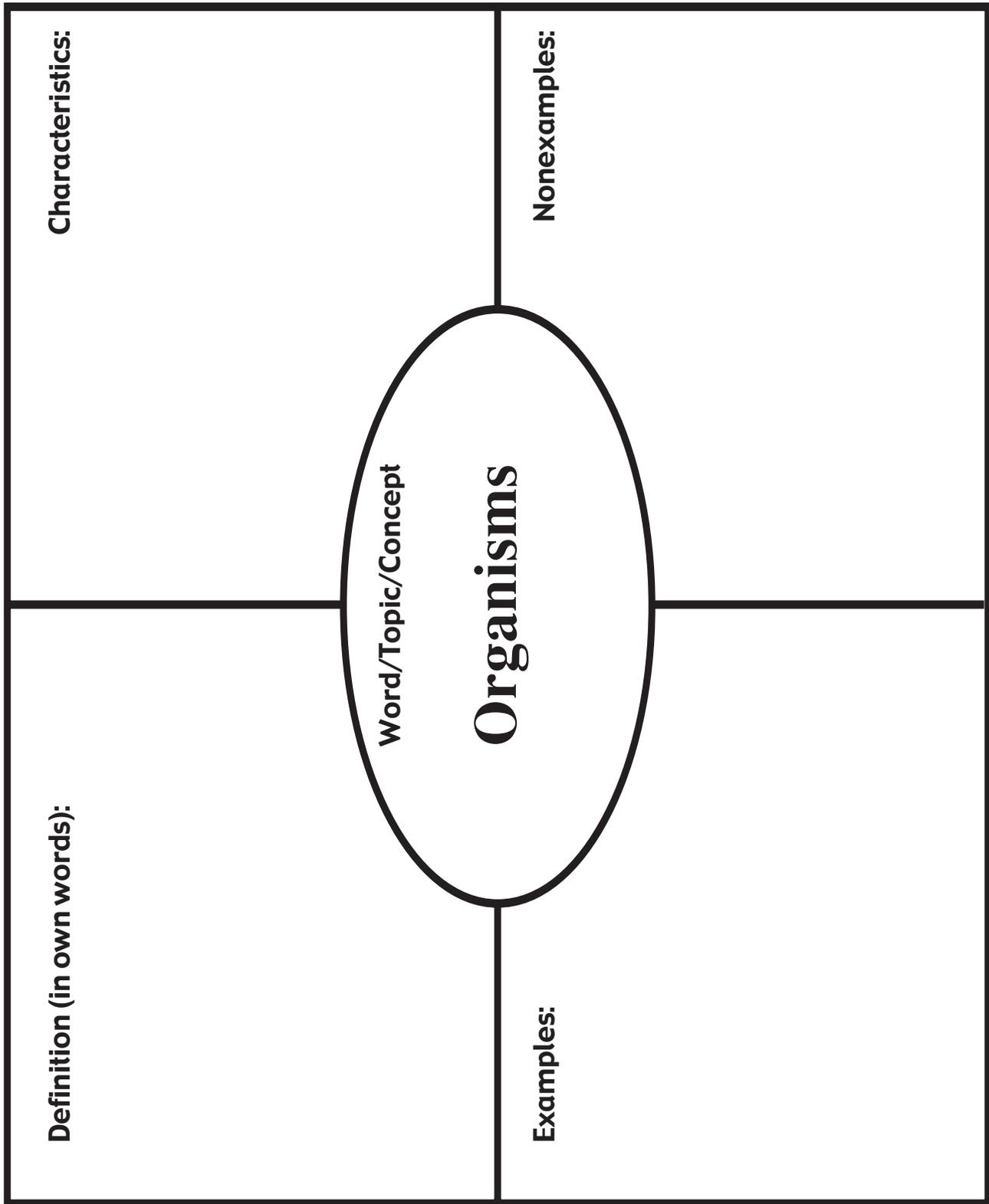


Vocabulary Sheet

<p>Might Have Characteristics:</p>	<p>Nonexamples:</p>
<p>Word/Topic/Concept</p> <h2>Living Things</h2>	
<p>Must Have Characteristics:</p>	<p>Examples:</p>







Creature Observations

Name _____ Team _____

Creature Observed _____

Questions to think about as you observe your creature:

- What does it eat?
- How does it eat?
- How does it move?
- Where does it live?
- How does it reproduce?
- Is it harmful or helpful?

List the things you already know about your creature.

List the things you can learn by observing your creature.

What do you wonder about your creature?

What living things do you think the creature needs in its environment to stay alive?

What nonliving things do you think the creature needs in its environment to stay alive?

Draw your creature. Measure your creature and record its size.

Plot Study Journal Page

Observers' Names: _____

Nonliving Things	Living Things
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Air Temperature _____ degrees F</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Soil Temperature _____ degrees F (Make a small hole and place the bulb end of the thermometer into the hole and cover it with soil. Wait 2 minutes and record the temperature.)</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Light (circle one) Full Sun Part Sun Full Shade</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Dirt Draw a close-up view of the dirt.</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>Other Nonliving Things Draw and describe.</p> </div>	<p style="text-align: center;">Draw and Describe</p> <div style="border: 1px solid black; height: 150px; margin-bottom: 10px;"> <p>Plants</p> </div> <div style="border: 1px solid black; height: 150px; margin-bottom: 10px;"> <p>Animals</p> </div> <div style="border: 1px solid black; height: 150px;"> <p>Once Living Things</p> </div>

Plot Study Journal Page

Plot Map

Draw a map of your plot on this grid. Make drawings and write the names of the living and nonliving things in your plot. Place the drawings and names on the grid in the same places as they are on the plot. Make sure to point the **N** arrow to the North before you start.

5					
4					
3					
2					
1					
	A	B	C	D	E

Name: _____

Finding Forces

Identify ten different activities performed by family members in the first column. In the second column, classify the force used as a push, a pull, or both.

Activity	Force Used
Example: Opening the drapes	Pulling
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Name: _____

Data Recording Chart

LOAD (eraser)	FORCE POSITION	FULCRUM	FORCE (# of paper clips)
11"	1"	6"	
11"	1"	8"	
11"	1"	4"	
11"	1"	7"	Prediction: Actual:
11"	1"	5"	Prediction: Actual:

Name: _____

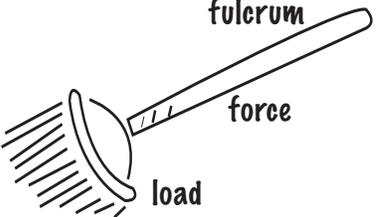
Data Recording Chart

LOAD (eraser)	FORCE POSITION	FULCRUM	FORCE (# of paper clips)
11"	1"	6"	
11"	1"	8"	
11"	1"	4"	
11"	1"	7"	Prediction: Actual:
11"	1"	5"	Prediction: Actual:

Name: _____

Locating Levers

Identify five different examples of levers found in your home. Draw a picture of each and label the load, the fulcrum, and the force. Classify each of the levers. See the example below:

Item	Picture	Type of Lever
Example: <p style="text-align: center;">broom</p>	 <p style="text-align: center;">third-class lever</p>	<p style="text-align: center;">third-class lever</p>

Name: _____

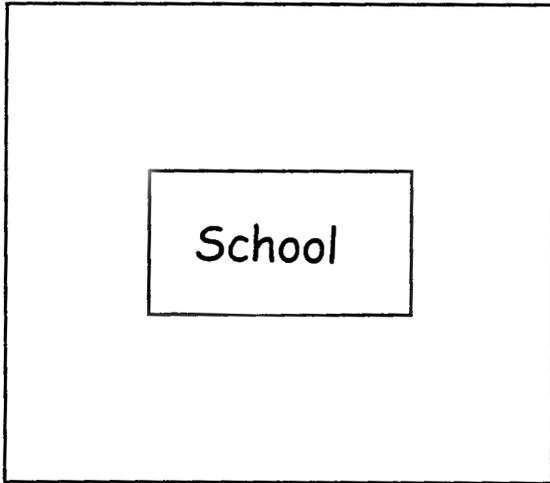
Collision Zone

	What do you predict will happen when the balls collide?	What did you observe happening when the balls collided?
Steel / Cork		
Glass / Wood		
Cork / Rubber		
Glass / Steel		
Wood / Rubber		
Cork / Glass		
Steel / Wood		
Rubber / Glass		
Wood / Cork		
Rubber / Steel		

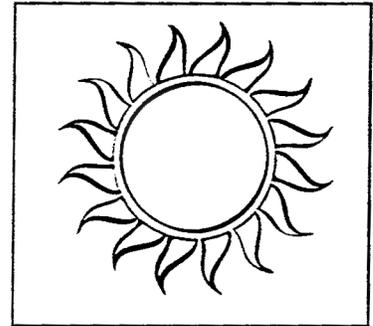
Name: _____

How Hot or Cold Is It?

Location:



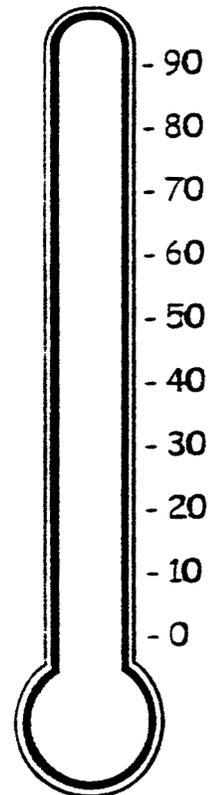
Amount of sunlight:



Time: Temperature

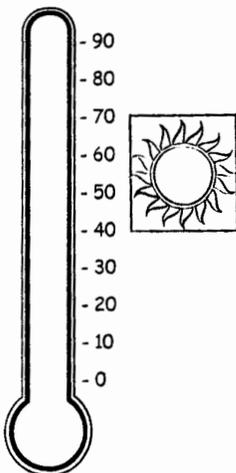
Time:	Temperature
1 minute	
2 minutes	
3 minutes	

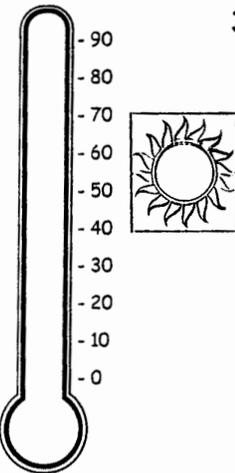
Final Temperature:

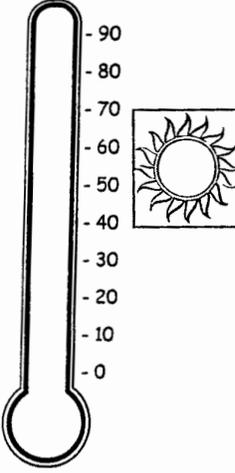


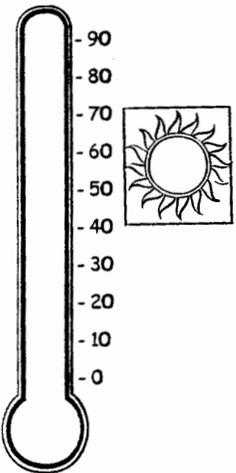
From Hottest to Coldest

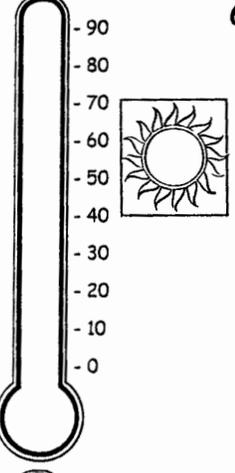
Draw the temperature of each group, then place them in order from hottest to coldest.

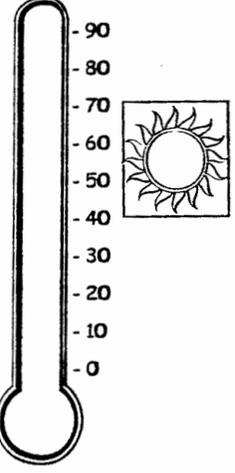
1. 

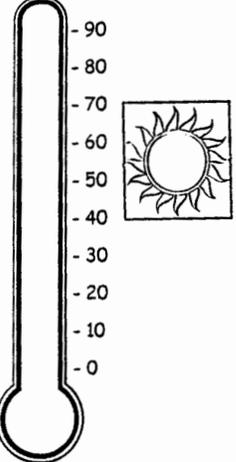
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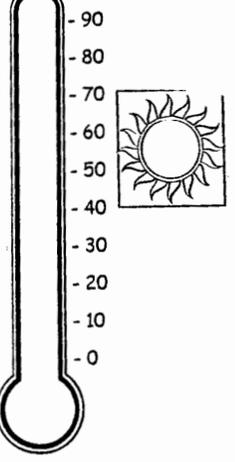
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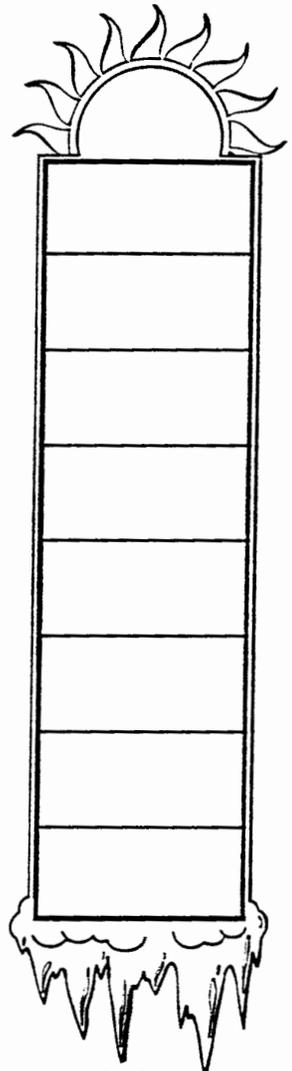
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Hottest



Coldest

How much light was in the hottest areas? _____

How much light was in the coolest areas? _____

Name: _____

Ralphie is Hot!

Draw five ways to protect Ralphie from the heat of the sun.



My Book About Heat and Light

Name: _____

Insulators

Question: Which material will keep heat in the longest?

Hypothesis: I think _____

Materials: You will need 1 styrofoam container, 1 folded newspaper, 1 towel, and 3 small cups. Use the thermometers from your kit.

Steps:

1. Fill 3 small cups with hot water.
2. Take the temperature of each cup.
3. Wrap each cup with an insulator.
4. Measure the temperature of each cup every minute for 4 minutes.

Conclusion:

	0 minutes	1 minute	2 minutes	3 minutes	4 minutes
Cup in newspaper					
Cup in styrofoam					
Cup in towel minu					

Hot to Cold

Question: Which room in your house is the hottest? Whis room is the coldest?

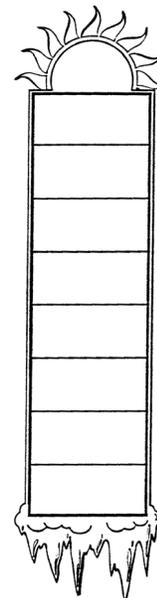
Hypothesis: I think _____

Materials: Use the thermometers from your kit.

Steps:

1. Measure the temperature in six rooms.
2. Leave the thermometers for 5-10 minutes.
3. Also observe how much sunlight in each room.

	Room	Temperature
1.		
2.		
3.		
4.		
5.		
6.		



Solar Cooking

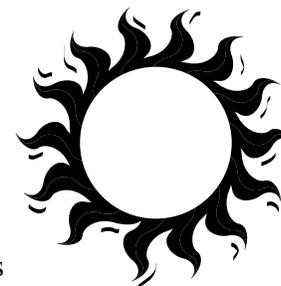
Question: How can I use the sun’s heat to cook my food?

Hypothesis: I think _____

Materials:

- 1 bowl covered in foil (shiny side out)
- clear plastic wrap to cover top
- marshmallows

- 1-2 graham cracker squares
- chocolate chips



Steps:

1. Place graham cracker in bowl.
2. Place chocolate chips and marshmallow on top of cracker.
3. Cover with plastic wrap.
4. Place in direct sunlight.

Conclusion:

Sprouts!

Question: Do seeds need heat to sprout?

Hypothesis: I think _____

Materials: From the kit, find the following:

2 plastic bags
seeds

4 cotton balls

Steps:

1. Place 2 cotton balls in each bag.
2. Place a few seeds on the cotton and slightly moisten with water.
3. Place 1 seed bag in a cool or cold area.
4. Place 1 seed bag in a warm area.
5. Observe for one week.

Conclusion: Which seeds grew better?

Observations:

Heat From Rubbing!

Question: Which two things rubbed together make the most heat?

Hypothesis: I think _____

Materials:

1 thermometer or heat sensor

Items to test

Steps:

1. Choose items from around the house to rub together (wood, rubber, plastic)
2. Take the temperature before and after rubbing.

Conclusion: Which made the most heat?

Item 1	Item 2	Time	Temperature

Heat From Machines

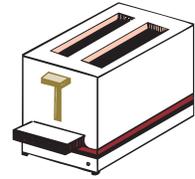


Question: Which machines in your house give off the most heat?

Hypothesis: I think _____

Materials:

Thermometers from the Science Kit



Steps:

1. Take the temperature of the machine.
2. Tape or attach a thermometer to it.
3. Turn the machine on for five minutes.
4. Test the temperature after another 5 minutes.

Conclusion: Which made the most heat?

Machine	Temp. While Off	5 Minutes	10 Minutes	Difference

Dear Parents,

Your child has checked out a Heat Science Kit, with materials included to do some science experiments at home. This kit is provided so that families may be actively involved in doing science together. This kit has been checked out for one week, and then needs to be returned to the classroom.

Please be sure that the thermometers and heat sensor are returned with the kit. Your child may keep all other materials, including their Experiment Booklet.

Suggestions for using the kit:

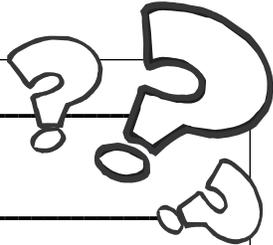
- Reserve 30 - 60 minutes for the kit activities during the week.
- Listen to each other.
- Offer assistance only when needed.
- Ask questions such as . . .
 - **What** happened?
 - **Why** do you suppose that happened?
 - **Where** have you seen this happen before?
 - **What** do you think would happen if . . .?
- Accept answers your child gives.
- Enjoy the time together!

Name: _____

My Science Experiment

My Question: _____

_____ ?



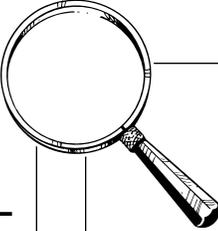
My Hypothesis

I think _____

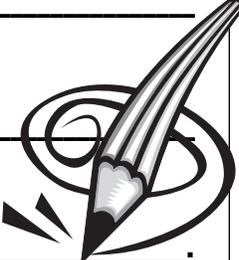
_____.

<p>My Materials</p> 	<p>My Plan</p>
---	-----------------------

My Observations	My Results
See _____ _____	
Smell _____ _____	
Touch _____ _____	
Hear _____ _____	



My Answer to the Question: _____



My New Question: _____

_____ ?

Name: _____

Heat From Machines

Question: Which machines will produce heat?

Hypothesis: _____

Experiment: Try some mechanical and electrical machines to see which produce heat.

	Machine	Elec.	Mech.	Heat?	Off	On	Difference
1.							
2.							
3.							
4.							

Conclusion: I found out that _____

Discovery: The most interesting thing I observed _____

**Professional Development Activity
Evaluation Form 2002-03
Utah State Office of Education**

Course Title	Elementary CORE Academy
Facilitator	_____
Dates	_____ to _____
Location	_____

	N/A	Strongly disagree	Disagree	Agree	Strongly Agree
1. Inservice aligned with the Utah Core Curriculum.	0	1	2	3	4
2. Useful assessment practices related to subject were presented.	0	1	2	3	4
3. Time allocated for this professional development was appropriate to meet my learning needs. If your answer was "strongly disagree" or "disagree", please check one of the following:	0	1	2	3	4
		___ More time needed			
		___ Less time needed			
4. Inservice was well organized.	0	1	2	3	4
5. Facilitator(s) and presenter(s) clearly stated objectives of professional development.	0	1	2	3	4
6. Presenter(s) had adequate knowledge of subject matter.	0	1	2	3	4
7. Professional development provided information relevant to my classroom.	0	1	2	3	4
8. Accommodations and facilities promoted learning.	0	1	2	3	4
9. I will recommend this professional development experience to other teachers.	0	1	2	3	4

10. Rate the use and effectiveness of each mode of instruction in this professional development.

	Not Used	Used Occasionally	Used Often	Not Used Effectively	Used Effectively
a) Lecture	0	1	2	0	1
b) Hands-on	0	1	2	0	1
c) Cooperative Groups	0	1	2	0	1
d) Discussion	0	1	2	0	1
e) Technology	0	1	2	0	1
f) Field Trips	0	1	2	0	1

11. How do you plan to implement the information from this professional development into your classroom instruction?

12. In what way will this professional development provide long-term benefit to the quality of your instruction?

13. What suggestions do you have for improving this professional development?

If you wish to send additional comments regarding this professional development experience, or to indicate other professional activities you would like to take in the future, please email or phone:

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CONFIDENTIAL INFORMATION FOR FEDERAL REPORTING ONLY

1. Check the category that best describes your school position:

- Teacher School and/or District Administrator / Supervisor
 Grade Level
 Pre-service teacher candidate Other (Specify: _____)

2. Gender: Male Female

3. How many students, total, did you teach during the previous school year? _____
How many students do you expect to teach in the coming school year? _____

4. Are you teaching at a Title I School?

- Yes I am No I am not I don't know

School _____ District _____