ELEMENTARY
CORE Academy

UTAH STATE OFFICE OF EDUCATION & UTAH STATE UNIVERSITY

3RD GRADE

2008 Participant Handbook

UTAH STATE OFFICE OF EDUCATION

UtahState UNIVERSITY

ELEMENTARY CORE ACADEMY

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Organizations:

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

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UTAH STATE OFFICE OF EDUCATION

Leadership…Service…Accountability

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Dear CORE Academy Teachers:

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

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

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

Sincerely,

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

Funding Sources

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

Major funding for the Academy comes from the following sources:

Federal/State Funds:

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

ESEA Title II

Utah Math Science Partnership

District Funds:

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

School Funds:

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

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

Additionally, numerous school districts, individual schools, and principals in Utah have sponsored teachers to attend the Academy. Other educational groups have assisted in the development and delivery of resources in the Academy.

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

Goals of the Elementary CORE Academy

Overall

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

The Academy will provide elementary teachers in Utah with:

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

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

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Utah Elementary Mathematics Core Curriculum

Introduction

Most children 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 building beliefs about what mathematics is, about what it means to know and do mathematics, and about themselves as mathematical learners. Students use mathematical tools, such as manipulative materials and technology, to develop conceptual understanding and solve problems as they do mathematics. Students, as mathematicians, learn best through participatory experiences throughout the instruction of the mathematics curriculum.

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

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 (logically explaining and justifying a solution to a problem), and engaging (seeing mathematics as sensible, useful, and doable, and being able to do the work) (NRC, 2001).

The most important observation about the five strands of mathematical proficiency is that they are interwoven and interdependent. This observation has implications for how students acquire mathematical proficiency, how teachers develop that proficiency in their students, and how teachers are educated to achieve that goal. At any given moment during a mathematics lesson or unit, one or two strands might be emphasized. But all the strands must eventually be addressed so that the links among them are strengthened. The integrated and balanced development of all five strands of mathematical proficiency should guide the teaching and learning of school mathematics. Instruction should not be based on the 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 and revised by a community of Utah mathematics

teachers, mathematicians, university mathematics educators, and State Office of Education specialists. It was critiqued by an advisory committee representing a wide variety of people from the community, as well as an external review committee. The Core reflects the current philosophy of mathematics education that is expressed in national documents developed by the National Council of 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. 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.

- Each grade level begins with a brief description of areas of instructional emphasis which can serve as organizing structures for curriculum design and instruction.
- The INTENDED LEARNING OUTCOMES (ILOs) describe the skills and attitudes students should acquire as a result of successful mathematics instruction. They are found at the beginning of each grade level and are an integral part of the Core.
- 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.
- INDICATORS are observable or measurable student actions that enable students to master an Objective. Indicators can help guide classroom instruction.
- MATHEMATICAL LANGUAGE AND SYMBOLS STUDENTS SHOULD USE includes language and symbols students should use in oral and written language.
- EXPLORATORY CONCEPTS AND SKILLS are included to establish connections with learning in subsequent grade levels. They are not intended to be assessed at the grade level indicated.

Guidelines Used in Developing the Elementary Mathematics Core

The Core is:

Consistent With the Nature of Learning

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. 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 and skills. 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 Core is designed to encourage a variety of interactive learning opportunities. Instruction should include recognition of the role of mathematics in the classroom, school, and community.

Comprehensive

By emphasizing depth rather than breadth, the Elementary Mathematics Core seeks to empower students by providing a comprehensive background in mathematics. Teachers are expected to teach all the standards and objectives specified in the Core for their grade level, but may add related concepts and skills.

The Core is:

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

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 handbook is also available for teachers and has sample lessons on each topic for each grade level. The 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. The 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.

Based Upon the National Council of Teachers of Mathematics Curriculum Focal Points

In 2006, the National Council of Teachers of Mathematics (NCTM) published *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics* (NCTM, 2006). This document is available online at http://www.nctm.org/focalpoints. This document describes three focal points for each grade level. NCTM's focal points are areas of emphasis recommended for the curriculum of each grade level. The focal points within a grade are ***not the entire curriculum*** for that particular grade; however, Utah's Core Curriculum was designed to include these areas of focus.

Intended Learning Outcomes for Third through Sixth 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 acquire as a result of successful mathematics instruction. They are an essential part of the Mathematics Core Curriculum and provide teachers with a standard for student learning in mathematics.

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

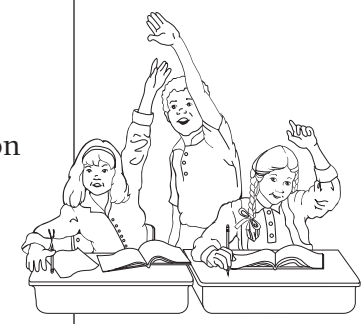
ILOs for mathematics:

1. **Develop a positive learning attitude toward mathematics.**
2. **Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.**
3. **Reason logically, using inductive and deductive strategies and justify conclusions.**
4. **Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.**
5. **Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.**
6. **Represent mathematical ideas in a variety of ways.**

Significant mathematics understanding occurs when teachers incorporate ILOs in planning mathematics instruction. The following are ideas to consider when planning instruction for students to acquire the ILOs:

1. **Develop a positive learning attitude toward mathematics.**

   When students are confident in their mathematical abilities, they demonstrate persistence in completing tasks. They pose mathematical questions about objects, events, and processes while displaying a sense of curiosity about numbers and patterns. It is important to build on students' innate problem-solving inclinations and to preserve and encourage a disposition that values mathematics.



2. **Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.**

   Problem solving is the cornerstone of mathematics. Mathematical knowledge is generated through problem solving

as students explore mathematics. To become effective problem solvers, students need many opportunities to formulate questions and model problem situations in a variety of ways. They should generalize mathematical relationships and solve problems in both mathematical and everyday contexts.

3. **Reason logically, using inductive and deductive strategies and justify conclusions.**

   Mathematical reasoning develops in classrooms where students are encouraged to put forth their own ideas for examination. Students develop their reasoning skills by making and testing mathematical conjectures, drawing logical conclusions, and justifying their thinking in developmentally appropriate ways. Students use models, known facts, and relationships to explain reasoning. As they advance through the grades, students' arguments become more sophisticated.

4. **Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.**

   The ability to express mathematical ideas coherently to peers, teachers, and others through oral and written language is an important skill in mathematics. Students develop this skill and deepen their understanding of mathematics when they use accurate mathematical language to talk and write about what they are doing. When students talk and write about mathematics, they clarify their ideas and learn how to make convincing arguments and represent mathematical ideas verbally, pictorially, and symbolically.

5. **Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.**

   Students develop a perspective of the mathematics field as an integrated whole by understanding connections within mathematics. Students should be encouraged to explore the connections that exist with other disciplines and between mathematics and their own experiences.

6. **Represent mathematical ideas in a variety of ways.**

   Mathematics involves using various types of representations including concrete, pictorial, and symbolic models. In particular, identifying and locating numbers on the number line has a central role in uniting all numbers to promote understanding of equivalent representations and ordering. Students also use a variety of mathematical representations to expand their capacity to think logically about mathematics.

Third Grade Mathematics Core Curriculum

By the end of grade three, students develop understandings of multiplication and division of whole numbers. They use properties to develop increasingly more sophisticated strategies to solve problems involving basic multiplication and division facts. They relate division to multiplication. Students understand fraction equivalence for simple fractions; they recognize that the size of a fractional part is relative to the size of the whole. They understand meanings of fractions to represent parts of a whole, parts of a set, or distances on a number line. They compare and order simple fractions by using models, benchmark fractions, or common denominators.

Students investigate, analyze, and classify two-dimensional shapes by their sides and angles. They decompose, combine, and transform polygons to understand properties of two-dimensional space and use those properties to solve problems. Students construct and analyze frequency tables, bar graphs, picture graphs, and line plots and use them to solve problems.

Standard I: **Students will understand the base-ten numeration system, place value concepts, simple fractions and perform operations with whole numbers.**

Objective 1: Represent whole numbers up to 10,000, comprehend place value concepts, and identify relationships among whole numbers using base-ten models and symbolic notation.

a. Read, write, and represent whole numbers using standard and expanded form.

b. 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).

c. Identify the place and the value of a given digit in a four-digit numeral and round numbers to the nearest ten, hundred, and thousand.

d. Order and compare whole numbers on a number line and use the symbols <, >, ≠, and = when comparing whole numbers.

e. Identify factors and multiples of whole numbers.

Standard I:

Students will understand the base-ten numeration system, place value concepts, simple fractions and perform operations with whole numbers.

Objective 2: Use fractions to describe and compare parts of the whole.

a. Identify the denominator of a fraction as the number of equal parts of the unit whole and the numerator of a fraction as the number of equal parts being considered.

b. Define regions and sets of objects as a whole and divide the whole into equal parts using a variety of objects, models, and illustrations.

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

d. Place fractions on the number line and compare and order fractions using models, pictures, the number line, and symbols.

e. Find equivalent fractions using concrete and pictorial representations.

Objective 3: Model problems involving addition, subtraction, multiplication, and division.

a. Demonstrate the meaning of multiplication and division of whole numbers through the use of a variety of representations (e.g., equal-sized groups, arrays, area models, and equal jumps on a number line for multiplication, partitioning and sharing for division).

b. Use a variety of strategies and tools, such as repeated addition or subtraction, equal jumps on the number line, and counters arranged in arrays to model multiplication and division problems.

c. Demonstrate, using objects, that multiplication and division by the same number are inverse operations (e.g., 3 x ☐ = 12 is the same as 12 ÷ 3 = ☐ and ☐ = 4).

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

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

Objective 4: Compute and solve problems involving addition and subtraction of 3- and 4-digit numbers and basic facts of multiplication and division.

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

b. Find the sum or difference of numbers, including monetary amounts, using models and strategies such as expanded form, compensation, partial sums, and the standard algorithm.

c. Compute basic multiplication facts (0-10) and related division facts using a variety of strategies based on properties of addition and multiplication (i.e., commutative, associative, identity, zero, and the distributive properties).

Mathematical language and symbols students should use:
sum, difference, expanded form, factor, product, array, multiple, numerator, denominator, halves, thirds, fourths, sixths, eighths, divisor, dividend, quotient, greater than, less than, equal to, <, >, =

Exploratory Concepts and Skills

- Extend multiplication and division to larger-digit numbers.
- Use concrete objects and visual models to add and subtract common decimals.
- Investigate the distributive property of multiplication over addition for single-digit multipliers (e.g., 7 x 15 is equivalent to 7 x (10 + 5) is equivalent to (7 x 10) + (7 x 5).

Standard II: **Students will use patterns, symbols, operations, and properties of addition and multiplication to represent and describe simple number relationships.**

Objective 1: Create, represent, and analyze growing patterns.

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

b. Describe how patterns are extended using manipulatives, pictures, and numerical representations.

Objective 2: Recognize, represent, and simplify simple number relationships using symbols, operations, and properties.

a. Represent numerical relationships as expressions, equations, and inequalities.

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

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

d. Recognize and use the commutative, associative, distributive, and identity properties of addition and multiplication, and the zero property of multiplication.

Standard II:

Students will use patterns, symbols, operations, and properties of addition and multiplication to represent and describe simple number relationships.

Mathematical language and symbols students should use:
growing patterns, expressions, equations, <, >, =

Exploratory Concepts and Skills

- Use concrete materials to build an understanding of equality and inequality.
- Explore properties of equality in number sentences (e.g., when equals are added to equals, then the sums are equal; when equals are multiplied by equals, then the products are equal.

Standard III: Students will describe and analyze attributes of two-dimensional shapes.

Objective 1: Describe and compare attributes of two-dimensional shapes.

a. Identify, describe, and classify polygons (e.g., pentagons, hexagons, octagons).

b. Identify attributes for classifying triangles (e.g., two equal sides for the isosceles triangle, three equal sides for the equilateral triangle, right angle for the right triangle).

c. Identify attributes for classifying quadrilaterals (e.g., parallel sides for the parallelogram, right angles for the rectangle, equal sides and right angles for the square).

d. Identify right angles in geometric figures, or in appropriate objects, and determine whether other angles are greater or less than a right angle.

Objective 2: Demonstrate the meaning of congruence through applying transformations.

a. Demonstrate the effect of reflection, translation, or rotation using objects.

b. Determine whether two polygons are congruent by reflecting, translating, or rotating one polygon to physically fit on top of the other.

Mathematical language and symbols students should use:
polygon, attribute, quadrilateral, equilateral triangle, isosceles triangle, right triangle, pentagon, hexagon, octagon, parallel, right angle, reflect, translate, rotate, slide, flip, turn, congruent

Exploratory Concepts and Skills

- Explore line symmetry and rotational symmetry.
- Investigate two-dimensional representations of three-dimensional objects.
- Explore properties of equality in number sentences (e.g., when equals are added to equals, then the sums are equal; when equals are multiplied by equals, then the products are equal.

Standard III:

Students will describe and analyze attributes of two-dimensional shapes.

Standard IV: **Students will select and use appropriate units and measurement tools to solve problems.**

Objective 1: Select and use appropriate tools and units to estimate and measure length, weight, capacity, time, and perimeter of two-dimensional figures.

a. Describe the part-whole relationships (e.g., 3 feet in a yard, a foot is 1/3 of a yard) between metric units of length (i.e., centimeter, meter), and among customary units of length (i.e., inch, foot, yard), capacity (i.e., cup, quart), and weight (i.e., pound, ounce).

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

c. Measure capacity using cups and quarts, and measure weight using pounds and ounces.

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

e. Describe perimeter as a measurable attribute of two-dimensional figures, and estimate and measure perimeter with metric and customary units.

Objective 2: Solve problems involving measurements.

a. Determine simple equivalences of measurements (e.g., 30 inches = 2 feet and 6 inches; 6 cups = 11/2 quarts; 90 min. = 1 hr. 30 min.).

b. Compare given objects according to measurable attributes (i.e., length, weight, capacity).

c. Solve problems involving perimeter.

Standard IV:

Students will select and use appropriate units and measurement tools to solve problems.

Mathematical language and symbols students should use:

measure, unit, metric system, customary system, length, pound, ounce, centimeter, meter, inch, foot, yard, capacity, weight, perimeter

Determine elapsed time in hours (e.g., 7:00 a.m. to 2:00 p.m.)

Exploratory Concepts and Skills

- Determine the value of a combination of coins and bills.
- Count back change from a single purchase.

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, frequency tables, line plots).

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," "likely," "unlikely," and "impossible."

b. Conduct simple probability experiments, record possible outcomes systematically, and display results in an organized way (e.g., chart, graph).

c. Use results of simple probability experiments to describe the likelihood of a specific outcome in the future.

Mathematical language and symbols students should use:
data, table, chart, graph, frequency table, line plot, pictograph, bar graph, likely, certain, outcome, impossible outcome

Exploratory Concepts and Skills

- Predict outcomes of simple experiments.

Standard V:

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

Utah Elementary Science Core Curriculum

Introduction

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

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

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

Organization of the Elementary Science Core

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

The Science Core Curriculum's organization:

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

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

Guidelines

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

Eight Guidelines Were Used in Developing the Elementary Science Core

Reflects the Nature of Science

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

As described in these ILOs, students will:

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

Coherent

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

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

Developmentally Appropriate

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

Encourages Good Teaching Practices

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

Comprehensive

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

Feasible

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

Useful and Relevant

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

Encourages Good Assessment Practices

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

The Most Important Goal

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

Third Grade Science Core Curriculum

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

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

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

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

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

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

SAFETY PRECAUTIONS:

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

Intended Learning Outcomes for Third Grade Science

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

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

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

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

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

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

Third Grade Science Standards

Science Benchmark

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

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

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.**

Science Benchmark

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

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

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

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

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

b. Identify characteristics of nonliving things.

c. Classify living and nonliving things in an environment.

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

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

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

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

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

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

Science language students should use:

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

Science Benchmark

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

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

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.

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

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

Science Benchmark

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

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

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

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

a. Compare temperatures in sunny and shady places.

b. Observe and report how sunlight affects plant growth.

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

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

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

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

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

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

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

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

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

Science language students should use:

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

Facilitated

Activities

Day 2 – Invitation to Learn

What Is Differentiation?

"…a purposeful process for adapting the teaching and learning processes of the classroom to accommodate the needs of all learners…it is an especially useful tool for insuring that all students have access to and are appropriately supported in their acquisition of important mathematical knowledge."

Carol Ann Tomlinson

Day 3 – Faclitated Activity

Choosing an Approach

"Students should consolidate and practice a small number of computational algorithms for addition, subtraction, multiplication and division that they understand well and can use routinely… Having access to more than one method for each operation allows students to choose an approach that best fits the numbers in a particular problem."

NCTM

Differentiation Self Assessment

These nine attitudes and skills typify teachers who help all learners. Read each statement and assess yourself.

1. I establish clarity about curricular essentials.

   (I know what is important for my students to know about the subjects I teach.)

   Always Often Sometimes Never

2. I accept responsibility for learner success.

   (If a student has not learned a thing of importance, the teacher has not taught well enough.)

   Always Often Sometimes Never

3. I develop communities of respect.

   (Teacher and students accept and understand commonalities and differences.)

   Always Often Sometimes Never

4. I build a personal awareness of what works for each student.

   Always Often Sometimes Never

5. I develop classroom management routines that contribute to success.

   Always Often Sometimes Never

6. I help students become effective partners in their own success.

   Always Often Sometimes Never

7. I develop flexible classroom routines.

   (Think about instructional pacing, furniture arrangement and grouping options, supplementary materials at various levels, etc.)

   Always Often Sometimes Never

8. I expand my repertoire of instructional strategies.

   Always Often Sometimes Never

9. I reflect on individual student progress with an eye toward curricular goals and personal student growth.

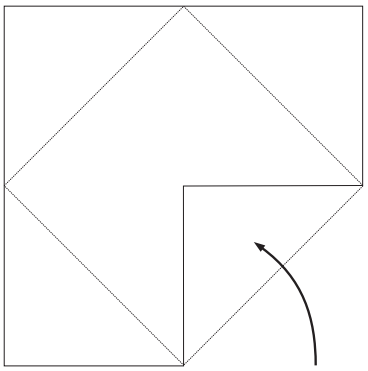
   (Consider how you use assessment to plan for instruction, tracking and reporting student growth.

   Always Often Sometimes Never

My Capacity Flip Book

Name _____

4 1/2 inch square for center gallon piece inside • 3 squares measuring 6 3/4 • Fold outside corners to center to make another square. Place each square inside each other. Place the 4 1/2 inch square inside the inner most square.



_____ cut

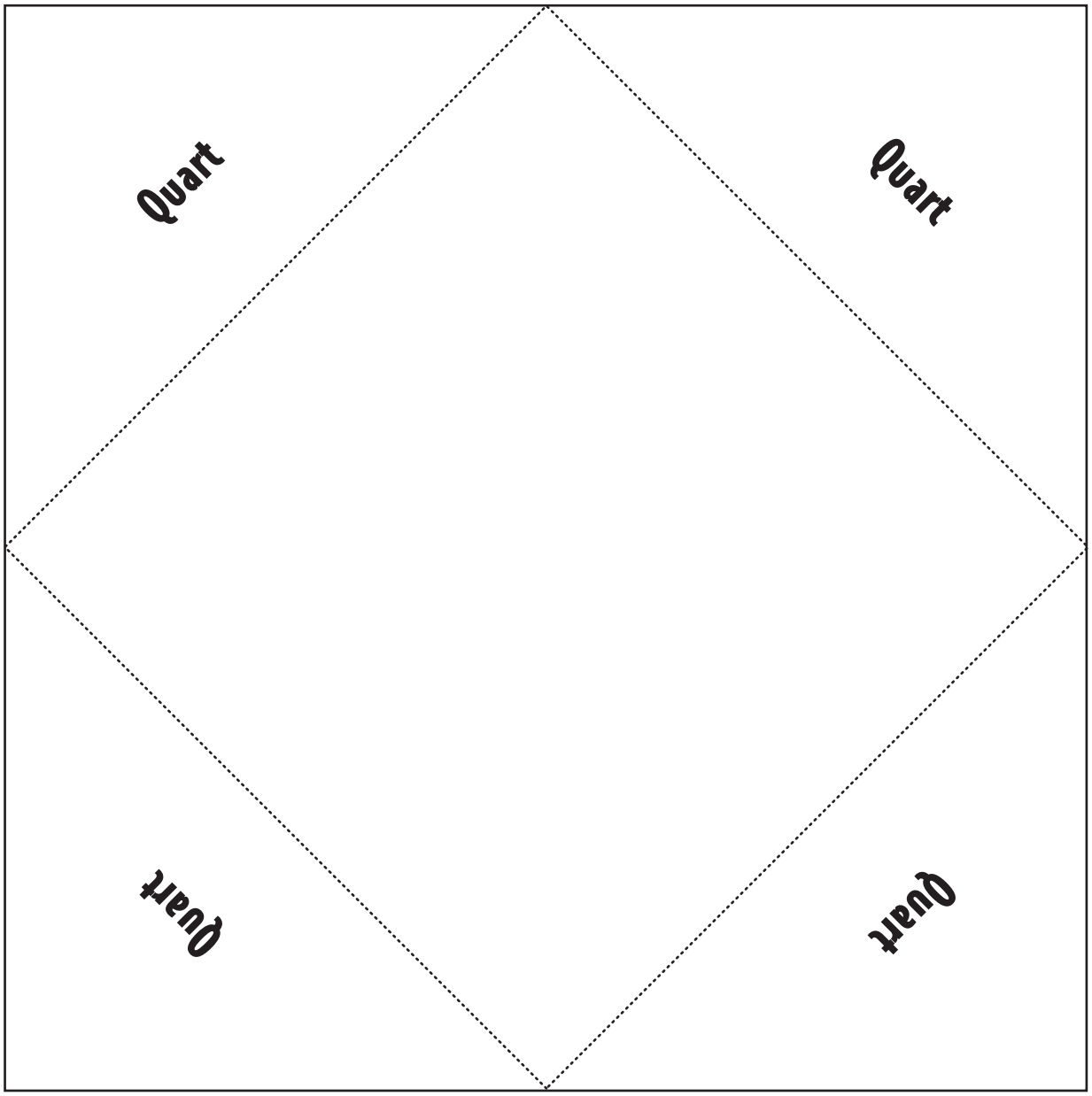
..... fold

Gallon

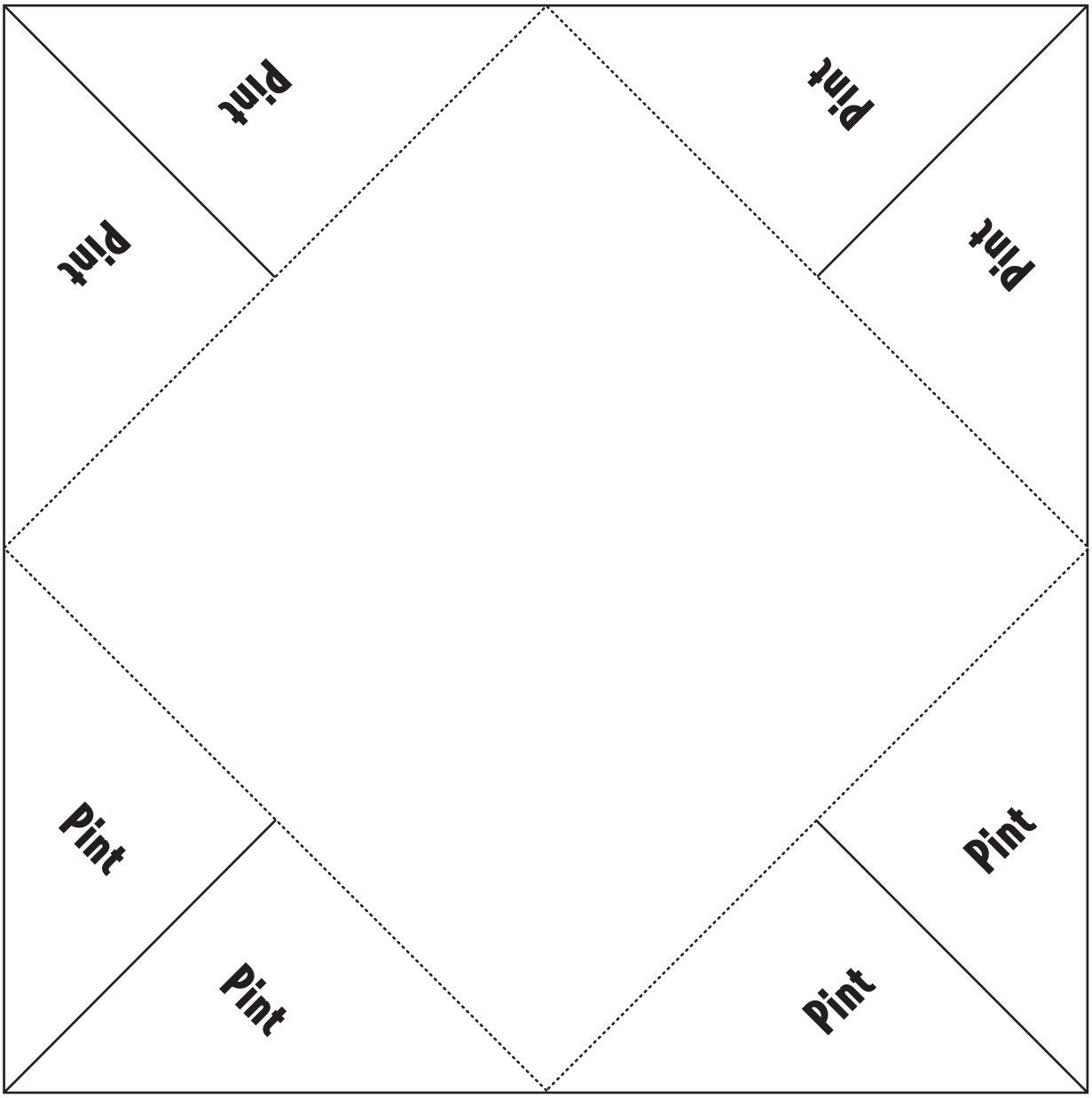
Gallon

for 2 separate books

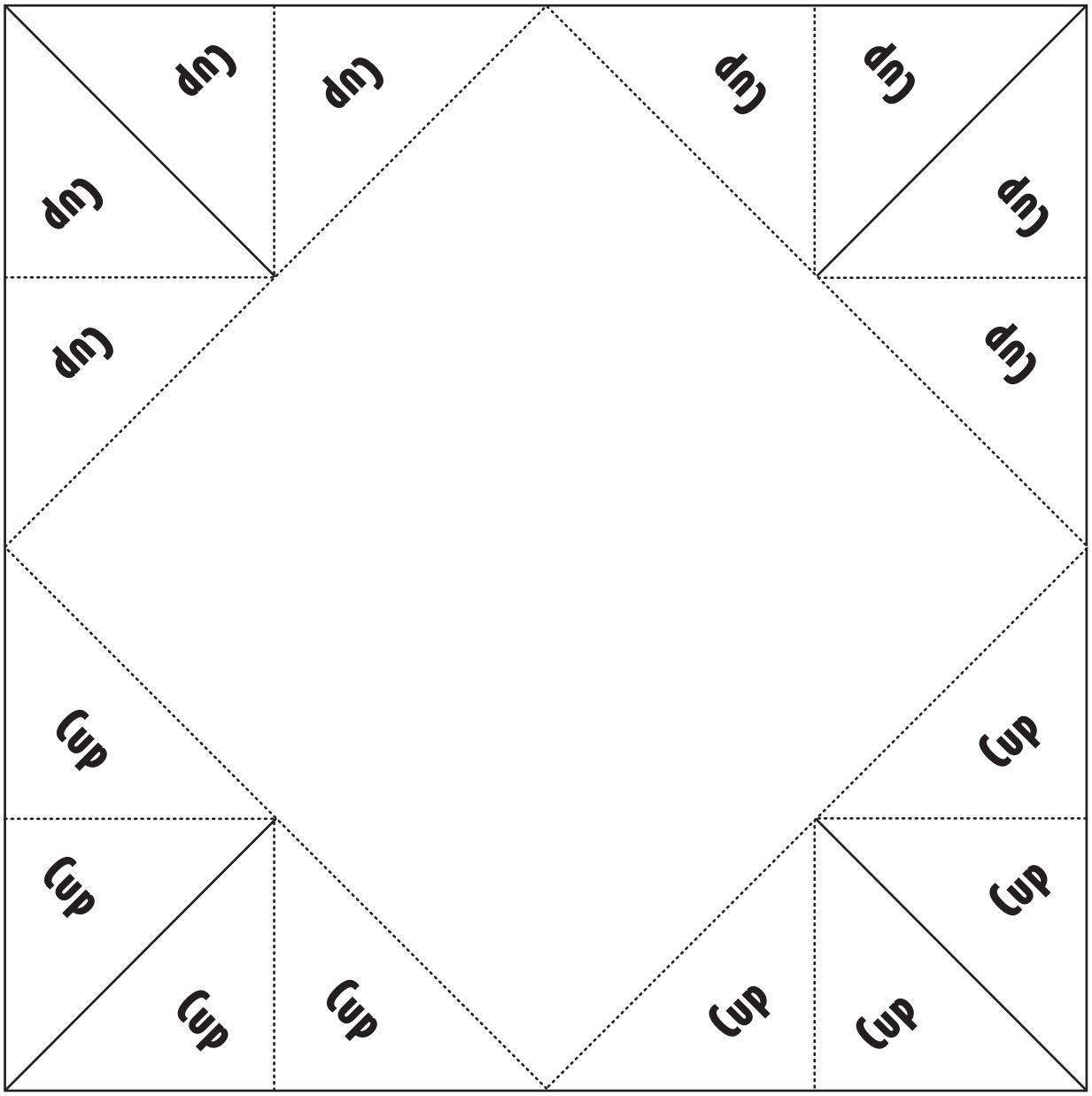
Quart



Pint

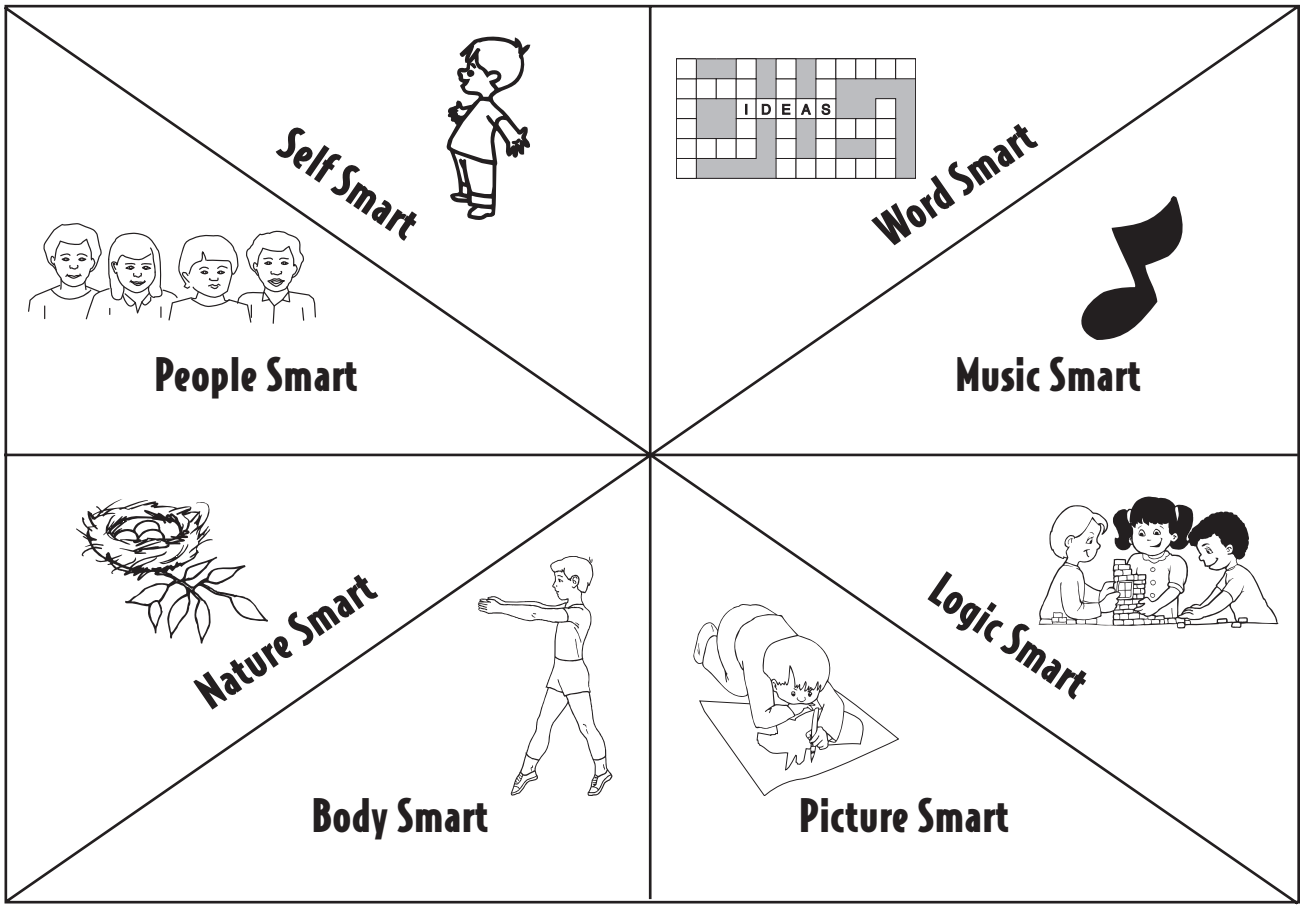


Cup



How do you Learn

Self Smart	Word Smart	Music Smart	Logic Smart
I am aware of my own feelings. I can control my anger by giving "I" messages. I can listen to directions and work on my own.	I understand word rules and I can read. I can spell by spelling out the words.	I love to sing. I can play an instrument. I can clap on beat.	I am good at math. I like hands-on activities and science. I like puzzles and I like to figure things out.
Picture Smart	**Body Smart**	**Nature Smart**	**People Smart**
I am good at drawing and coloring. I can picture in my head what I want to draw.	I am coordinated in P.E. and sports. I enjoy physical games.	I enjoy nature by observing and listening to sounds around me.	I get along with others. I love to talk and have lots of friends. I think of others first.

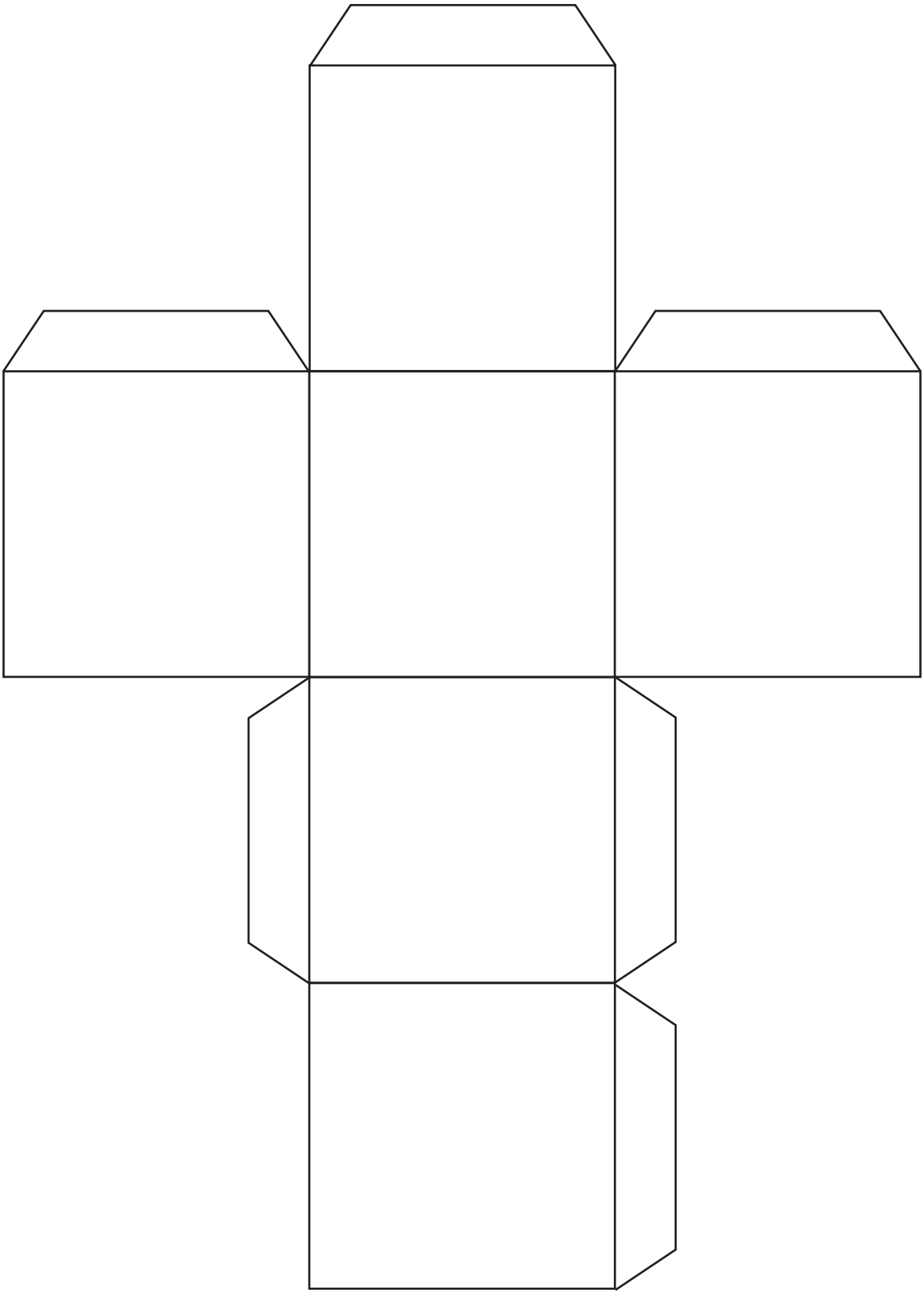


How Do You Learn: Concept Cards

Isosceles triangle	**Equilateral triangle**	**Right angle**	**Parallelogram**
Rectangle	**Square**	**Greater than a right angle**	**Less than a right angle**
Pentagon	**Hexagon**	**Octagons**	**Push**
Pull	**Airplane**	**Gravity**	**Earth**

Heat	**Light**	**Sun**	**Living Things**
Time	**Ruler**	**Foot**	**Expanded form**
Place value	**Number line**	**Parallel**	**Thermometer**

Cube



Tiered Activities

Using tiered lessons is a way for teachers to ensure that all students, regardless of ability level or learning style, progress towards mastery of learning goals and objectives. Tiered assignments, also known as scaffolding, allow for differing levels of readiness and performance levels. The entire class works toward the same essential understanding (parallel tasks) but their paths to that goal depend upon their abilities and learning styles (varied levels of depth and varied degrees of support).

The following are guidelines for planning tiered lessons/assessments. Teachers should:

1. Using the Core Curriculum, pick a concept or skill that needs to be learned (e.g. "What's the ultimate measurable objective?").
2. Think of an activity that matches the objective.
3. Use pre-assessment data to determine the individual needs of the students. Consider students performing above grade level, students below grade level, English Language Learners, and students with varying learning style preferences (multiple intelligences).
4. Take another look at the selected activity. Target its complexity to be appropriate for on-grade-level learners.
5. Modify the activity or assessment to meet the needs of the other learners in the class. Within one activity, there will be several tiers to meet the wide range of student needs.
6. Seek consultation from the specialists in the school, as well as fellow colleagues.
7. Teach the activity, including the various tiers.
8. Reflect and refine.

Remember, tiered lessons provide differentiation because of varied levels of complexity, not necessarily because of varied quantities of work. Here are a few considerations for educators, as they implement use of tiered activities to scaffold for student learning:

- Just because students are above grade level, that does not mean they should be given more work.
- Just because students are below grade level, that does not mean they should be given less work.
- All tiered activities should be interesting and appealing.
- All tasks should provide a challenge.

Tomlinson, C.A. (1999). *The Differentiated Classroom*. (p. 83). Alexandria, VA: ASCD.

Conklin, W. (2007). *Applying Differentiation Strategies*. (pp. 149-202). Huntington Beach, CA: Shell Education.

McCombs, B.L. (1995). Understanding the keys to motivation to learn. *Noteworthy Perspectives: What's Noteworthy on Learners, Learning, and Schooling.*

Math III-1 & 2

Activities

Geometry

Mr. Bo Jangle, What's Your Angle?

Standard III:

Students will describe and analyze attributes of two-dimensional shapes.

Objective 1:

Describe and compare attributes of two-dimensional shapes.

Intended Learning Outcomes:

4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
5. Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.

Content Connections:

Math IV-1; Elapsed Time
Science II-1; Living and Nonliving Things

Math Standard III

Objective 1

Connections

Background Information

Students need to have been previously taught that an angle consists of two rays sharing the same endpoint. Angles look different depending on their size. Right angles are most commonly referred to as a square corner because of the 90° angle they make. Angles smaller than a right angle, are referred to as acute and will fit inside any right angle because they measure less than 90°. Angles greater than a right angle are named obtuse. They are bigger than 90°. These angles make up shapes found in the world around us.

Research Basis

Milson, J. (1979). "Geometry and the Real World." *School Science and Mathematics*. 79(8) 695-700.

Students often feel geometry is useless because it is presented abstractly not relating to their own world. Only when teachers apply geometry to other areas do students begin to appreciate it. When students are shown the practical side of geometry as applied to science and geometric forms found around them, they feel this mathematic area is worth learning.

Browning, C. A., Garza-Kling, G., & Sundling, E. H. (2007). "What's Your Angle on Angles?" *Teaching Children Mathematics*. 14(5) 283-287.

Students need to be given the opportunity to explore the definition of an angle. As students are exposed to angles using different mediums, they will begin to grasp what an angle actually is. Their angle definitions need to be challenged and expanded upon continually. Students need to share their discoveries with others.

Materials

- ❑ Chenille stems

Invitation to Learn

Students will play the role of a clock. Their arms will create times found throughout the day. First students will make 9:30 using their arms. This time represents a right angle. Next students will elapse time to 10:15. This will represent an angle that is greater than the right angle. Finally students will once again elapse time to make 11:05. This angle is less than a right angle. After students have made all three angles with their arms they will recreate them using 3-6 inch chenille stems. These angles will be taped into their math journals. Students will label each angle.

Materials

- ❑ *Shapes, Shapes, Shapes*
- ❑ Crayons
- ❑ *Growing Tree*
- ❑ *I Spy an Angle*
- ❑ Scissors
- ❑ Glue

Instructional Procedures

1. Students will look at the book *Shapes, Shapes, Shapes* to identify angles found in the real world. With the help of the teacher and an angle tool they will classify each angle they find as right, greater, or less than a right angle.
2. Students will cut out the *Growing Tree* and paste it into their math journals.
3. Using red, blue, and green crayons students will classify each angle the tree limbs make.
   - Red – Right Angles, Blue – Greater Than Right, Green – Less Than Right
4. Students will create a book where they will record angles found within their environment. Students need to cut out the two boxes found on the *I Spy an Angle* page. The top box is the title and should be glued to the front of their books. The bottom box is a reference guide for students. It needs to be glued to the back of the title page.
5. Using a local newspaper, have students search for items that contain angles. Once they find some, they need to cut them out and glue them into their books. After each one is glued, students need to indicate what type of angle it contains.
6. Students need to take their angle books and a pencil outside to the playground. They need to observe their environment and draw objects that contain angles in their books. When the students get back into the classroom they need to classify each angle that they drew.
7. Have students share with the class the items that they drew in their *I Spy an Angle* books. Allow them to explain the process they went through to classify each one of their angles.

Assessment Suggestions

- Bring into the classroom several real world items that contain angles. Have students classify each angle that is found in these items.

Curriculum Extensions/Adaptations/ Integration

- Take pictures of the environment that your students live in. Enlarge the pictures to 5x7 or 8x10. Compile these pictures into a book for your students to look at. Have your students go through these pictures searching for angles. As they find some, students can work with a partner to classify them.
- Find a local map of your area and enlarge it. Have your higher students search for roads that intersect. These students can determine what type of angle these intersecting roads create.
- Using a Zoome Tool Kit students need to create objects made up of all angle types. After they are finished have students classify several angles found within the creation.

Family Connections

- Have students take their *I Spy An Angle* books home. They need to draw three different items seen around their home environment. Each item must contain a different type of angle.

Additional Resources

Books

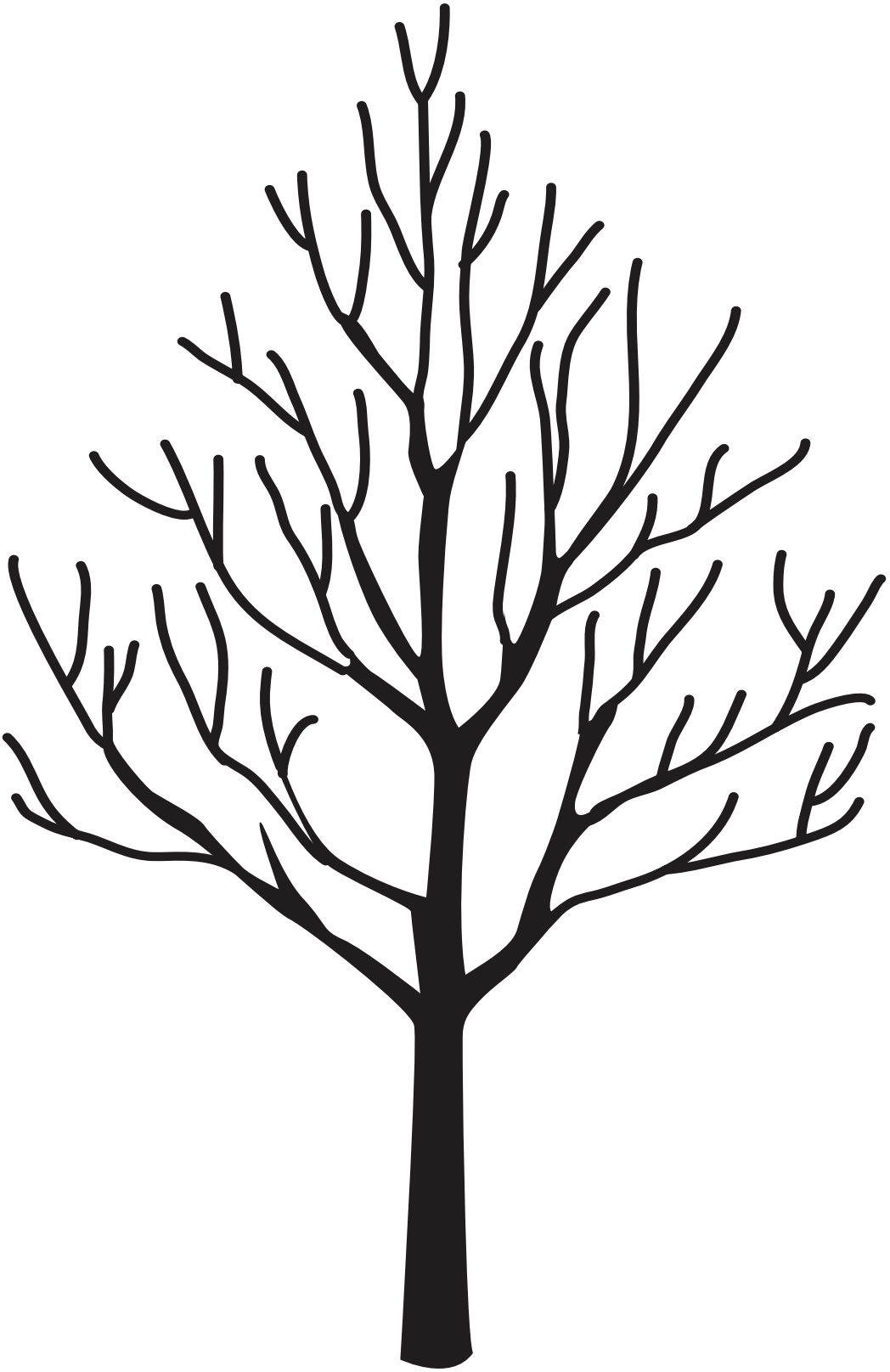
Shapes, Shapes, Shapes, by Tana Hoban; ISBN 0-688-14740-2

Sir Cumference and the Great Knight of Angleland, by Cindy Neuschwander; ISBN 1-57091-169-X

Web sites

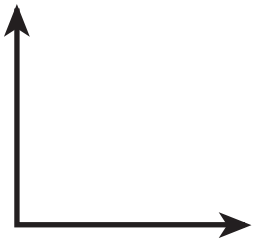
http://nlvm.usu.edu/en/nav/grade_g_2.html (national library of virtual manipulative)

Growing Tree

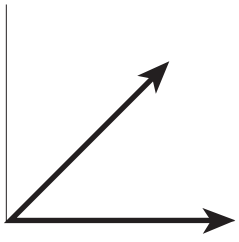


I Spy an Angle

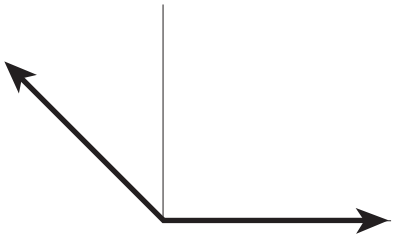
Reference Guide



Right Angle



Less Than a Right Angle



Greater Than a Right Angle

Try This Triangle Out For Size

Math Standard III

Objective 3

Connections

Standard III:

Students will describe and analyze attributes of two-dimensional shapes.

Objective 3:

Describe and compare attributes of two-dimensional shapes.

Intended Learning Outcomes:

4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
5. Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.

Content Connections:

Language Arts VIII-2; Writing to communicate effectively
Math V-1; Collect, organize, and display data

Background Information

Students need to understand that polygons are closed plane figures made up of line segments. The attributes of polygons vary according to the number of sides and types of angles they contain. Students need to learn that prefixes indicate the number of sides of a polygons. Those prefixes include the following: tri – three, quad – four, pent – five, hex – six, and oct – eight.

Research Basis

Boaler, J. (1998). "Open and Closed Mathematics: Student Experiences and Understandings." *Journal For Research in Mathematics Education*. 29(1) 41-62.

It is difficult for students to transfer classroom-learned math to situations in the real world. Teachers could help students overcome this by using different teaching methods to conquer math concepts. Math will become more exciting for students as they are given practical and investigative assignments. Students are challenged as they learn how to use their math knowledge in real world experiences.

Moyer, P. S. (2001). "Are We Having Fun Yet? How Teachers Use Manipulatives To Teach Mathematics." *Educational Studies in Mathematics*. 47(2) 175-197.

It has been proven that math manipulatives benefit students. Manipulatives need to be consistently and effectively used in the classroom. They show representations of abstract math concepts to our students. With the help of manipulatives, teachers also can make connections between a student's newly acquired math knowledge to those concepts once learned. It is up to the teacher to consistently learn new ways to implement the manipulatives into daily math instruction.

Invitation to Learn

Students need to make a right, equilateral, and isosceles triangle by using three pieces of chenille stems. Once the shapes are made, they will be used as bubble wands. Predict which triangle will make bigger bubbles. Place each wand into a soapy bubble solution and blow bubbles out. Discuss which triangle worked out better for students.

Materials

- ❑ Chenille stems
- ❑ Bubbles

Instructional Procedures

Which Triangle Is It?

Materials

- ❑ Drinking Straws
- ❑ Scissors
- ❑ Ruler
- ❑ Paper Clips
- ❑ *Which Triangle Is It?*

1. Cut the 9 plastic straws into the following segments: 1 straw – 4 inches, 5 straws – 6 inches, 2 straws – 7 inches, and keep one at full length.
2. All of the paper clips (9) need to be opened up.
3. To make a right triangle, insert one bent end of each paper clip into the following straw segments: 2 – 7 inch straws and the full length straw.
4. To make an equilateral triangle, insert one bent end of each paper clip into the following straw segments: 3 – 6 inch straws.
5. To make an isosceles triangle, insert one bent end of each paper clip into the following straw segments: 2 – 6 inch straws and 1 – 4 inch straw.
6. Students then will trace each triangle into their math journals. They need to indicate the length of each side and type of angles it has. Finally, students need to write the name of the triangle below the tracing. These triangles need to be placed in a pocket that students have created inside of their math journals.
7. Students will use the information now recorded in their math journals to create a bar graph found on *Which Triangle Is It?* They will indicate how many sides, equal sides, and types of angles each triangle has. Use the color code for each bar found on this worksheet.

Dribble, Shoot, Score

Materials

- ❑ *Dribble, Shoot, and Score*
- ❑ Basketball and Hoop
- ❑ Measuring tape
- ❑ Yarn
- ❑ Glue
- ❑ Scissors

1. Place several miniature basketball hoops around the classroom.
2. Divide students into groups and assign them an area around one of the miniature basketball hoops.

3. The basketball hoop will serve as one point of the triangle. Two other students will represent the other two points of a triangle. Groups will use a measuring tape to place these students at the appropriate places to create a right, equilateral, and isosceles triangle.
4. After each triangle is created, students will connect yarn between the basketball hoop and the two people. This will help them visualize what these triangles look like.
5. Students will cut out the basketball hoops found on *Dribble, Shoot, and Score* page.
6. Using the basketball hoop as a triangle point, students will create their own right, equilateral, and isosceles triangles in their math journals.

Materials

- ❑ *Trianglo*
- ❑ Bingo chips

Trianglo

1. Students are given a *Trianglo* card and 25 bingo chips.
2. Teachers will show students a picture of a real world item that contains some type of triangle in it. These triangles can either be classified as right, isosceles, or equilateral.
3. Students will determine which triangle it is and then place a bingo chip on a square that contains that triangle's name.
4. The student that has bingo chips placed in five squares straight across, down, or diagonally calls out trianglo.

Assessment Suggestions

- Give students a sheet of drawn triangles. Have students cut these shapes out. Once students cut the shapes have them classify each triangle as either being right, isosceles, or equilateral.
- Using a Zoome Tool Kit students need to create objects made up of all triangles. Once their object is finished they must classify the triangles found within it.

Curriculum Extensions/Adaptations/ Integration

- Buy a disposable camera for the class. Instruct students that they will receive the camera for one night. On the night that it is their turn students will take the camera home and photograph a picture of a triangle in the real world. After each

student has had a turn then get the film developed. Using the pictures they took, students will create a classroom book about classifying triangles.

Family Connections

- Have students write an article on how to make a sandwich. Students need to include how to cut the sandwich into one of the triangles they have learned about. After they write the article have students go home and actually do it. Students' parents must report back to the teacher on how it went.

Additional Resources

Books

Triangles, by Esther Sarfatti; ISBN 978-1-60044-669-6

A Triangle For Adaora, by Ifeoma Onyefulu; ISBN 978-1-84507-738-9

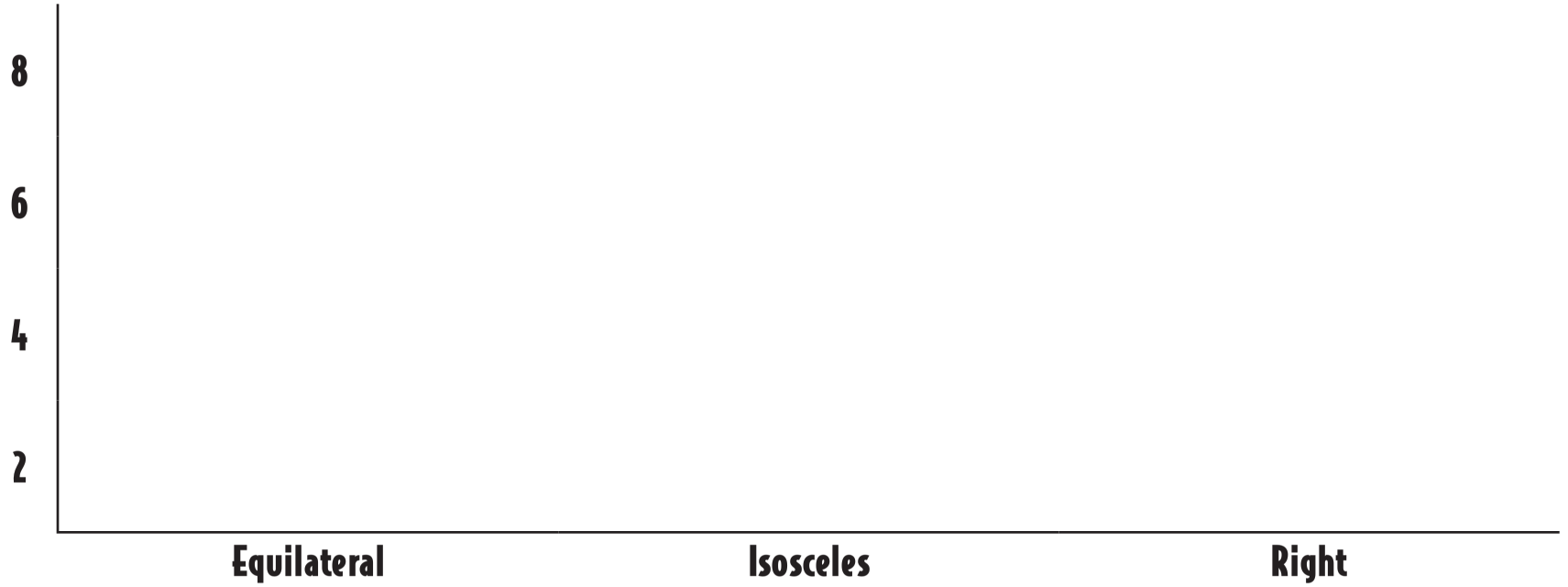
Triangles, Seeing Triangles All Around Us, by Sarah L. Schuette; ISBN 0-7368-5063-5

Triangles around Town, by Nathan Olson; ISBN 978-0-7368-6373-5

Web sites

http://www.teach-nology.com/web_tools/materials/bingo/5/

Which Triangle Is It?



Red	Number of Sides
Blue	Number of Equal Sides
Green	Number of Right Angles
Yellow	Number of Greater Than Right Angles
Purple	Number of Less Than Right Angles

Dribble, Shoot, and Score






Trianglo

Isosceles	Equilateral	Isosceles	Right	Equilateral
Right	Isosceles	Right	Equilateral	Isosceles
Equilateral	Isosceles	FREE SPACE	Right	Equilateral
Isosceles	Right	Equilateral	Equilateral	Right
Right	Isosceles	Isosceles	Isosceles	Equilateral

Equilateral	Right	Isosceles	Equilateral	Equilateral
FREE SPACE	Right	Right	Right	Isosceles
Isosceles	Right	Isosceles	Isosceles	Equilateral
Equilateral	Right	Equilateral	Isosceles	Isosceles
Equilateral	Right	Isosceles	Isosceles	Right

Trianglo

Equilateral	Isosceles	Equilateral	FREE SPACE	Equilateral
Isosceles	Right	Equilateral	Equilateral	Isosceles
Right	Right	Isosceles	Isosceles	Right
Right	Equilateral	Equilateral	Right	Right
Isosceles	Equilateral	Right	Isosceles	Equilateral

Equilateral	Right	Right	Equilateral	Isosceles
Isosceles	Equilateral	FREE SPACE	Equilateral	Equilateral
Right	Isosceles	Isosceles	Right	Equilateral
Equilateral	Isosceles	Isosceles	Equilateral	Right
Right	Right	Equilateral	Isosceles	Right

Science III

Activities

Force Motion

The Larger It Is the Harder It Falls

Science Standard III

Objective 1

Standard III:

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

Objective 1:

Demonstrate that gravity is a force.

Intended Learning Outcomes:

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

Content Connections:

Physical Fitness I; Health enhancing levels of fitness

Connections

Background Information

These activities can be done outside, in the gym or in the classroom – just move the desks. Children will be using large muscle groups to find out about gravity's power/force!

Research Basis

Linksman M.Ed., Ricki, National Reading Diagnostics Institute, 2007. The Fine Line between ADHD and Kinesthetic Learners. Association for Comprehensive Neuro Therapy

This was a comparison and contrast between children who have been diagnosed with ADHD and children who require large muscle involvement in their learning. Because of the required movement they may well be kinesthetic learners not ADHD children. However, our classrooms are usually geared to the children who learn via their hearing (auditory) and eyesight (visual). It is sometimes very difficult to incorporate the kinesthetic learner into the classroom, hence, the following activities.

Invitation to Learn

Drop a stone (this stone should weigh about 15 pounds), plastic ball, rubber ball and a large paper clip into a container of sand (the container is about 24x16x8 with 3 inches of play sand in the bottom). Examine the craters. Ask "why are some of the craters larger and deeper than others?" "What made the objects fall toward Earth?" "What would happen if we didn't have gravity?"

Then have the children partner measure from the floor to their partner's knees (the average is approximately 17 inches). Show this on

Materials

- ❏ Pocket Folder
- ❏ 3x5 cards
- ❏ Pencil, pens, markers
- ❏ Heavy paper
- ❏ Straight-edge
- ❏ Ruler
- ❏ Paper clips
- ❏ Paper punch
- ❏ Raffia, string or ribbon
- ❏ *Physical Science for Children*

a yard stick – "it doesn't seem to be very far." "If it isn't very far then why does it hurt so much when you fall down?"

Instructional Procedures

Science Pocket Folder

1. Read *If*; by Sarah Perry.
2. Using the heavy paper, take the paper clip and straight-edge and use them to score a line 2 inches up from each of the longer sides, all the way across the paper. Scoring makes folding easier.
3. Fold both the edges toward the center of the paper and crease.
4. On this same side, using the ruler (it is smaller) and paper clip score a line every 4 inches. The score lines start at the top fold and run all the way through to the second fold.
5. Fold the paper, accordion style and crease.
6. Punch a small hole (hole punch) in the middle of each of the vertical edges about ¾ inch in and half way down the vertical edge; this will be used to thread and hold the book together.
7. The 3x5 cards are used to list the vocabulary definitions:

Science language	distance, force, gravity, weight, motion, speed, direction, simple machine

8. Each definition belongs in one of the pockets of the Science Pocket Folder with room for the activity items seen later on.
9. When the child does an experiment, at school or at home, they can describe, in pictures or words, how this experiment worked and place it behind the definition that they believe their experiment describes.
10. The Science Pocket Folder has enough pockets that the tools and instructions used in these experiments can be kept in the pocket folder as well.
11. The folder, cards with definitions, participation, drawings and explanations are the final assessment. They are a fine item to take home to parent(s) as well, and with the simple implements intact, the children will be able to demonstrate the experiments at home.

Gravity Specific Exercise

1. Leg lifts; Have the children lay flat, cross their arms across their chest (these cannot move) and raise their legs to a 45 degree angle. This is not difficult, as the leg is in line with the hip and rests or *balances* (forces are equal) there. Now have them try a 30 degree angle. It can't be held for long because of gravity.
2. Balance; Have the children sit on the floor/ground and again cross their hands across their chest (these cannot move). Next, have them bend their knees and lift their feet off the floor. They are trying to find a balance point on their pockets where they can resist gravity and remain stable. Use a timer to see how long people can remain balanced. Chart it!
3. Human dominos; Children sit next to each other in one long line; again the arms are across the chest (they cannot move). Their shoulders should be touching their partner's shoulders. Their knees are bent. Have the children raise their feet off the ground and have one person tip to the right or left. Everyone will fall like a group of dominos!
4. Ant crawl; for two minutes have the girls then the boys ant crawl. Their stomachs are towards the ceiling and they are using their arms and legs to crawl around the area like an ant. No one can do this for 2 minutes because gravity is pulling them down. The only ones to make it were the ones who held still and placed themselves in balance with the gravitational pull of Earth.

Assessment Suggestions

- This is where the 3x5 cards come into play. Give the children 4 cards (extras should be available, if necessary) and have them draw or describe what happened in each of the above activities. Then they place their cards behind the definition card in the pocket folder. If the explanations are accurate; points are awarded.

Curriculum Extensions/Adaptations/ Integration

- Tug of war; demonstrates balance of force and the force of pulling. During the game, incline planes become obvious when children brace themselves. Include ideas for integration for other curricular areas (use appropriate subject area headings).

Family Connections

- The Science Pocket Folder will contain multiple options for experimentation at home.

Additional Resources

Media

All About Forces & Gravity, The Schlessinger Science Library; Physical Science for Children; introduces all the vocabulary and has many demonstrations that cannot be duplicated in the classroom. About 23 minutes long.

Articles

Do you know Your Child's Learning Style? Education Articles/Differentiated Learning, By Jane Saeman, March 4,

Web sites

http://www.edarticle.com

www.frsd.k12.nj.us/rfmslibrarylab/di/differentiated_instruction.htm

Super Paper Planes

Standard III:

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

Objective 2:

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

Intended Learning Outcomes:

2. Manifest Scientific Attitudes and Interests.
3. Understand Science Concepts and Principles.

Content Connections:

Math V; Collect and organize date to make predictions

Science Standard I

Objective 3

Connections

Background Information

The force used is air from the lungs. Therefore, the more air forced from the lungs the farther and faster something will go. What happens then, if you have three similar objects, the same design but of different *mass*?

Research Basis

Tomson, K. E. *Show and Tell: Journal Writing Every Day: Teachers Say It Really Works!* Education World. Professional Development, Curriculum.

An overview of journal writing in the classroom and the benefits derived from daily writing. The teachers who spoke ranged from high school to first grade. All believed that it improved writing skill; grammar, spelling, structure and communication abilities. The surprises were the enhancement of the teacher/student relationships and the willingness to write about all subjects, including math. Some stated that it was a slow daily process, but the rewards were more than worth the effort.

Invitation to Learn

This is a force, mass and measurement activity. Children work in pairs; one participates while the other measures. Children will create 3 planes, powered by a straw, out of 3 different kinds of paper. Find a place to set up. A long hallway is fine. Using masking tape set up a starting area by making a "toe" line. This is the spot where all participants will start. Then measure off 3 feet (1 yard), 6 feet (2 yards) and 9 feet (3 yards) and make tape lines with the measurements noted.

Materials

- ❑ *Super Paper Planes*
- ❑ Straw
- ❑ Paper squares
- ❑ Clear tape
- ❑ Large paper clips
- ❑ Paper tube
- ❑ Pencil
- ❑ Index cards

Instructional Procedures

1. Create the planes by using the paperclip to trace over the top of the pattern, press hard so the indentation can be seen and used. This makes it easier to fold.
2. Follow the instructions, make all three paper planes (the planes made out of the heavier paper will take a little more time.
3. Make a paper tube out of the lightest paper. It should be approximately 6 to 8 inches long; 2 inches for each plane.
4. Close one end of each tube by folding the paper back on itself and taping the folded edge.
5. The tube should be as air tight as possible.
6. The tube can be attached, with tape, to each plane, on the top or the bottom. It is the child's choice.
7. The children take turns standing at the "toe" line, inserting the straw into the paper tubes and using "lung" capacity to push the planes down the hallway.
8. Their partner records the results. The results can be graphed.
9. The children record the results of the plane activity on the three index cards; using mass or the weight of the plane as the writing criteria.

Assessment Suggestions

- Following directions; are the children able to successfully make the planes? Are they able to cooperate and participate with one another?
- 3 x 5 index card proper placement in the Science Pocket Folder
- Index card explanation

Curriculum Extensions/Adaptations/ Integration

- Try differently designed planes; larger – smaller.
- This activity requires some degree of small muscle coordination. Children with this complication may require some assistance from the teacher or their partner.

Family Connections

- Supply a copy of the Super Paper Planes template and instruction.
- Children can take this home and remake the planes out of multiple items.

Additional Resources

Books

The Great International Paper Airplane Book, by Jerry Mander, George Dippel and Howard Gossage; a Fireside Book Published By Simon and Schuster; New York

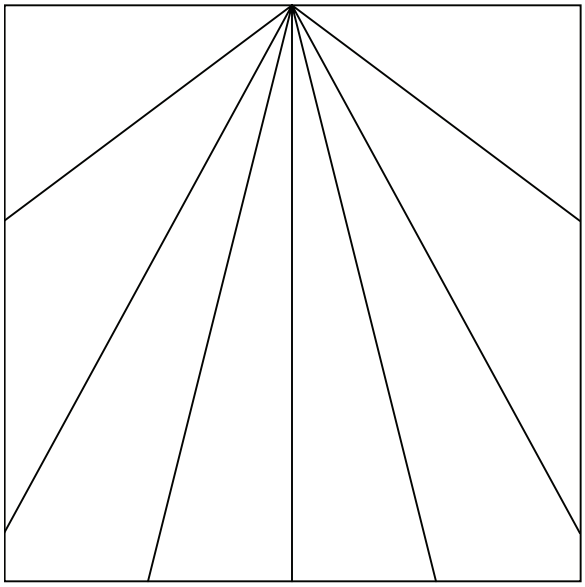
Web sites

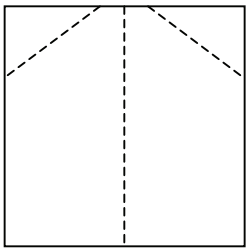
Flight Simulator - http://www.workman.com/etcetera/games/fliersclub/

http://www.zurqui.com/crinfocus/paper/airplane.html

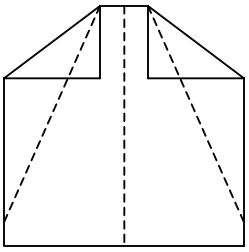
http://teacher.scholastic.com/writewit/diary/

Super Paper Planes

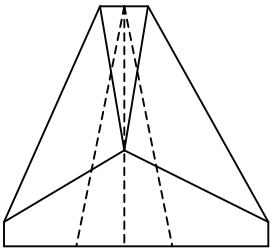




1. Crease on the center line and fold the corners inward.

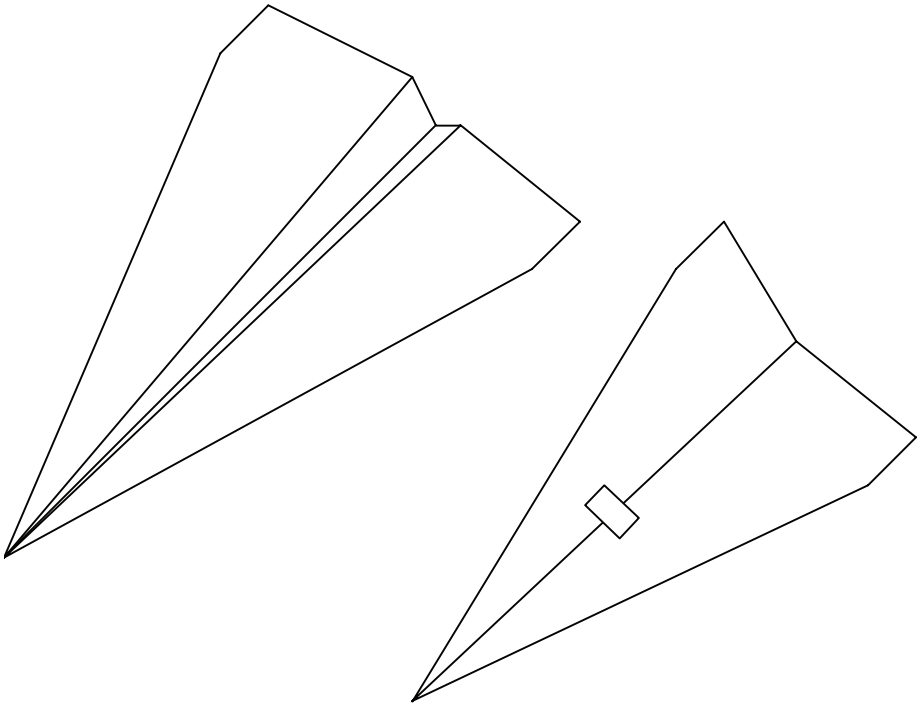


2. Fold again on dotted line.



3. Fold away from you on center line. Make opposite folds on dotted lines.

4. To get this.



5. Hold wings together with tape giving them a slight upward angle.

The paper tube can be attached, with tape to the top or bottom of the plane.

Catapult Creations

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.

Intended Learning Outcomes:

2. Manifest Scientific Attitudes and Interests.
4. Communicate Effectively Using Science Language and Reasoning.

Content Connections:

Math V; Collect and organize date to make predictions

Science Standard III

Objective 1

Connections

Background Information

Using a variety of easily found tools children will have an opportunity to observe, participate in creating and use catapults and levers. The children should understand the ideas of balance, force, motion, push and pull.

Research Basis

U.S. Department of Education. Office of Communications and Outreach. *Helping Your Child Learn Science*, Washington, D.C.

This article contains information about science and science activities that can be done simply at home and at other sites. There are multiple suggestions for working with teachers and within the school system along with a list of science related sources that does include books, magazines, science camps and other information. It helps a parent discuss science and "find" science in the community where the family resides.

Invitation to Learn

A pre-catapult launch – collect a variety of lever type objects such as paint sticks, plastic serving spoons, rulers and other items so that each small group of students will have one or more to try. Crumpled paper balls or giant marshmallows can be used for launching – in fact, both are preferable. The marshmallows must not be eaten but marked with the individual's initials, so that the missile may be reclaimed!

Materials

- ❑ Launch mechanism
- ❑ Target
- ❑ Large marshmallow
- ❑ Paper
- ❑ 3x5 cards

Instructional Procedures

1. The target is placed in the middle of the room
2. The children's desks are placed, equal distance from the target.
3. The students must remain sitting.
4. The "missile" must be touching the launching object before launch. It cannot be launched by hand.
5. The missile must be on the desk.
6. The children may set up the tools any way they wish.
7. Count to three and launch.
8. Provide a 3x5 index card.
9. After launch, introduce the word "lever." The main parts of the lever can be described; fulcrum, resistance force and effort force.

Assessment Suggestions

- This is a participation project. If the children are involved, cooperating and participating in their groups; points may be awarded.
- 3x5 index card describing their design – drawing is acceptable.
- The correct use of the vocabulary; the drawing can be labeled.

Materials

- ❑ 1 3x5 index card
- ❑ 3 large paper clips
- ❑ 1 bottle of liquid glue
- ❑ 10 tongue depressors or popsicle sticks
- ❑ 10 rubber bands of various size (I have many of these)
- ❑ 2 straws
- ❑ 1 plastic spoon
- ❑ 1 12 inch piece of string
- ❑ 1 pair of scissors
- ❑ 1 ruler; inches and metric
- ❑ 1 gallon size zip-lock bag (all materials go in here to give to the student groups)
- ❑ Target

Curriculum Extensions/Adaptations/ Integration

More Complicated Catapults

The students may use scissors, ruler and glue to help build the catapults, but they may not be part of the catapult itself. Allow the students to examine the contents of the bag and discuss the items and brainstorm before building; 5 minutes is a good amount of time. Allow the students to build for approximately 30 minutes and set a timer. As the students build ask them about their design and remind them of what the lever is and does. When the time is up, test the catapults! The target can be used again. Everyone will start the same distance from the target and the results will be measured and charted! Display their machines with the distance the paper or marshmallow flew. Add another experiment card to the Science Journal Pocket Folder, a photo of the machine is helpful.

Family Connections

- Try building a catapult at home; how far can a potato be launched. What kind of materials would be required to move an item of this size and weight?
- Plastic spoons and frozen peas make mini catapults and will biodegrade in the back yard.

Additional Resources

Books

Backyard Ballistics, by William Gurstelle; ISBN 1-55652-375-0

Web sites

http://www.knightforhire.com/catapult.htm

http://www.madison.k12.wi.us/toki/catapult.htm

http://www.science.howstuffworks.com/question127.htm

Tissue Parachutes

Science 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.

Intended Learning Outcomes:

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

Content Connections:

Language Arts: Standard 8: Writing: Students will write daily to communicate effectively for a variety of purposes and audiences.

Background Information

We have demonstrated that gravity is an extremely strong force with the use of muscles to fight gravity and dropping the rock and other items into the sand box. There are ways that the effect of that force can temporarily be reduced. Jets and prop-planes do make it into the atmosphere. Bubbles, seeds, pollen, dust and people can float for short periods of time.

Research Basis

Bulloch, K. L. (2004). *The Mystery of Modifying: Creative Solutions*. Education Service Center

We need to modify instruction to suit different children and their differing learning styles. This article is "how to…" It lists the learning difficulty and provides suggestions of what to do before the lesson and during the lesson. There are many, many suggestions offered. If one does not work there are others to try.

Invitation to Learn

The parachutes are simple to make and demonstrate the effect of gravity (pull) against the push of air. This exercise is extended by the use of a small fan which will increase the push or force of the air.

Materials

- ❑ Tissue paper
- ❑ String
- ❑ Clear tape
- ❑ Small fan
- ❑ Mini chocolate bars
- ❑ 3x5 cards

Instructional Procedures

1. Tape a piece of string to each corner of two parachutes.
2. Gather all four of the strings on each parachute and tape, along with a candy bar, all four ends together.

3. The piece of tissue paper can be folded into quarters, so that a peak at the center of the tissue paper can be held for release.
4. The parachutes can also be folded into quarters again and tossed into the air.

Notes:

- If the tissue squares are precut it will save time and frustration as the tissue is quite frail and it may be frustrating to those individuals who have small motor coordination difficulties.
- The pieces of string (100 percent cotton crochet thread is strong, light and inexpensive) were cut by a small group of children.
- The properly measured pieces (4) were taped to different places on a table. The children measured, cut and sorted the groups, using the string templates.
- The Science Pocket Folder has enough pockets that the items used in these experiments can be kept in the pocket folder as well.

Assessment Suggestions

- After the experiments, the 3x5 cards will be completed and placed in the Science Pocket Folder, the following questions can be used as a guideline.
- Which parachute will come/came down first? Why?
- What happens when the force of wind (fan) is added to the activity?
- Does it change what happens to the parachutes? Why?

Curriculum Extensions/Adaptations/ Integration

- Find out why and how birds fly and glide.
- List adaptations for learners with special needs.
- Include ideas for integration for other curricular areas (use appropriate subject area headings).

Family Connections

- Fly a kite!

Additional Resources

Books

The Dragon Kite, by Nancy Lueen; ISBN-10:0152241973

Wilbur and Orville Wright: The Flight to Adventure, by Louis Sabin; Publisher; Mahwah, New Jersey: Troll Associates, 1983

Web sites

http://www.readingrockets.org/about

http://wings.avkids.com/Curriculums/Birds/paper_kites.html

Math I-1

Activities

Place Value

Place Value and Rounding

Standard I:

Students will understand the base-ten numeration system, place value concepts, simple fractions and perform operations with whole numbers.

Objective 1:

Represent whole numbers up to 10,000, comprehend place value concepts, and identify relationships among whole numbers using base-ten models and symbolic notation.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
6. Represent mathematical ideas in a variety of ways.

Content Connections:

Math I-3; Estimation, place value with addition and subtraction

Math Standard I

Objective 1

Connections

Background Information

Students should have knowledge of place value of a given digit up to and including a five-digit numeral and have had a chance to practice and understand the concept of place value. They should have understanding of numbers and number sense. Students should be taught specific vocabulary relating to the lesson before you begin. This should include: numeral, digit, and place value. The first activities taught at the 2008 Core Academy on place value will give your students the background knowledge they will need to know before you teach the activities listed below.

Research Basis

Klein, K., & Jones, R., (2003). How Teachers Phrase Discussion Questions. Retrieved November 24, 2006, from Studies of Teaching 2003 Research Digest, Wake Forest University Leah P. McCoy, Editor

Classroom discussion is one of the most important teaching techniques used to help students learn and understand the information they are being taught. Discussion allows the students to become engaged with the material by formulating their own opinions, listening to other students' opinions, and applying specific information to a broader situation.

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

Students do not fully understand math concepts if they cannot relate it to something in their own experiences. The use of many

different techniques help make mathematics a pleasure rather than a chore. Students are more active learners and are more motivated when they work in small groups.

Invitation to Learn

Materials

- ❑ *Digit Cards*
- ❑ *Place Value Cards*

This activity is called "Place Value Match-Up". Have students draw five blanks in their journal to represent a five-digit number. You have the *Place Value Match-up Digit Cards* that include 0-9. You also have *Place Value Cards* that include 10,000s, 1,000s, 100s, and 10s. Shuffle the ten digit cards. Draw a card and announce the digit to the class. Each student writes that digit in one of his five blanks. After the digit is written it cannot be moved. Lay the card aside, and continue drawing and announcing four more cards. (Keep these cards together to use later). After you have drawn five cards, each student will have written a five digit number. Mix up the five discarded cards. Draw one place value match up digit card and one place value card. If a student's number matches both the digit card and the place value card then he earns one point. If a student has a match he/she can draw a circle around their number. Continue drawing four more pairs of cards: one each of the discarded digit cards and one of the place value cards. If all five of a student's digits match, he earns a bonus of five extra points for a total of ten points altogether.

Instructional Procedures

Materials

- ❑ *Rounding Mountains*
- ❑ *Number Lines*
- ❑ White Boards
- ❑ Overhead markers

Rounding

1. Each student should receive a *Rounding Mountains* sheet. Hand these out after you have taught them how to round using the rounding mountains.
2. The teacher should have an overhead made of the Rounding Mountains. Show the overhead to the students.
3. The first mountain on the left shows an example of rounding to the nearest 10. Show students the number 1,523 and have them say the number out loud. Explain to them that since we are rounding to the nearest 10 there is an arrow pointed to the two which is in the 10's place.
4. On the line left of the mountain shows the number 1,520 then point to the numbers starting with 0 and continue all the way to 10 going around the mountain.
5. On the line right of the mountain shows the number 1, 530.

6. Explain to the students that the numbers written on the lines are the two different numbers they would choose when rounding 1,523 to the nearest 10. (the 10 before the number and the 10 after the number)
7. Sing the song "The Bear Goes over the Mountain" but instead of saying the bear say the digit to the right on the arrow. For example, sing: Did the three go over the mountain, did the three go over the mountain, did the three go over the mountain? No, we didn't get up the mountain. So we know that this rounds to the number on the line closest to the three which is 1,520.
8. Repeat this with rounding to the nearest 100 and rounding to the nearest 1,000.
9. When rounding 1,523 to the nearest 1,000 your students may be confused because the number five is on top of the mountain. If you use the analogy of you holding a bowling ball and climbing the mountain. Once you got to the top would your momentum take you forward over the mountain or back down the mountain? Help them to understand that it would take you forward over the mountain, so it would round to 2,000.
10. Model using your rounding mountain sheet on the overhead before you hand out their sheet. I would model this until your class is ready to begin working on their own rounding mountain sheet.
11. Once students have practiced and have been assessed in using the rounding mountain sheet you can then begin introducing them to rounding with a number line.
12. Make an overhead of the *Number Lines* sheet.
13. Ask students to compare the rounding mountains to the number line. What is the same about the two different number lines and what is different about them?
14. Ask students the following question: Would you use the number line to round the same way you would use the mountain number line to round? Teach them that the rounding mountain has been stretched out to make a straight line which is now the number line.
15. Show the overhead of the *Number Lines* sheet.
16. The first number line on the left shows an example of rounding to the nearest 10. Show students the number 1,523 and explain to them that since we are rounding to the nearest 10 there is an arrow pointed to the two which is in the 10's place.

17. The number line begins with 1,520 and ends with 1,530. Show the number 1, 525 and ask why do you think they have put that number on the number line? (it is half way)
18. Have students show where 1,523 should go on the number line and put a dot on the line and name the dot 1,523.
19. Repeat this with rounding to the nearest 100 and rounding to the nearest 1,000 on the number line.
20. Make sure you have modeled this and your students understand how to use the number line before you hand out the number line sheet.
21. Give each student the *Number Line* sheet and have them practice rounding.
22. Students have learned to round numbers using a rounded number line and a straight number line. Now introduce them to rounding without using a number line.
23. Put a number on the board or overhead (e.g. 123) and tell students you are going to round this number to the nearest 10.
24. Put an arrow underneath the two which is in the 10's place. Underline the number three which is the number on the right side of the two.
25. The number three is the controlling number or the "Boss". It decides if we are going to keep the two which is in the 10's place the same or bump it up to a three.
26. Write 120 to the left side of our number and write 130 to the right side of our number.
27. Remind students of the mountain number line and decide if the controlling number would go over the mountain or would go down the mountain.
28. The controlling number would go down the mountain, so 123 would round to 120.
29. Model this many times using different numbers and round to the nearest 10, 100 or 1,000.
30. When students understand this concept then pass out the white boards and markers.
31. Model with your students as they practice rounding on their own white boards.
32. Put students in groups or partners and have them practice rounding on their white boards.

Assessment Suggestions

- The teacher should walk around and make sure students are completing the *Rounding Mountain* sheet and the *Number Lines* sheet correctly.
- Have students hand in their *Rounding Mountain* sheet and Number Line sheet so you can assess their work.
- Another way to assess is by having students work together and to assess each others *Rounding Mountain* and *Number Lines* sheets.
- When students begin rounding on their white boards the teacher should walk around making sure that each student understands the concept of rounding.

Curriculum Extensions/Adaptations/ Integration

- For advanced learners you can extend the Place Value Match-up game by including larger numbers. Students can play in groups so that you can adapt the game for each level in your classroom.
- For learners with special needs have them work together with a partner or group to complete their *Rounding Mountain* and number line sheet.
- An extension to the rounding activity with white boards is to make up number cards with three to five digit numbers. Underneath each number, write round to the nearest 10 or 100 or 1,000. Have students pair up in partners and give each partner 3-5 different cards. One partner would turn over a card and then each student would round their number on their white board. Then share it with their partner to see if they match. If they match turn over another card. If they don't match then help each other find the correct answer.
- Partner up your advanced learners and have them time each other to see how fast they can round their numbers. You can also have them race each other and the first one that completes their problem correctly gets a point.
- Advanced learners can round larger numbers to the nearest 10, 100 or 1,000. They can also round larger numbers to the nearest 10,000, 100,000 etc.

Family Connections

- Have students take home a *Rounding Mountain* and a *Number Lines sheet* and share what they have learned with their parents.
- Students can show their family members how they learned to round without using a number line. Those students who are advanced learners can race their parents or siblings when rounding different numbers to the nearest 10's, 100's, or 1,000's.
- Parents can help students create their own rounding game to share with the class.

Additional Resources

Articles

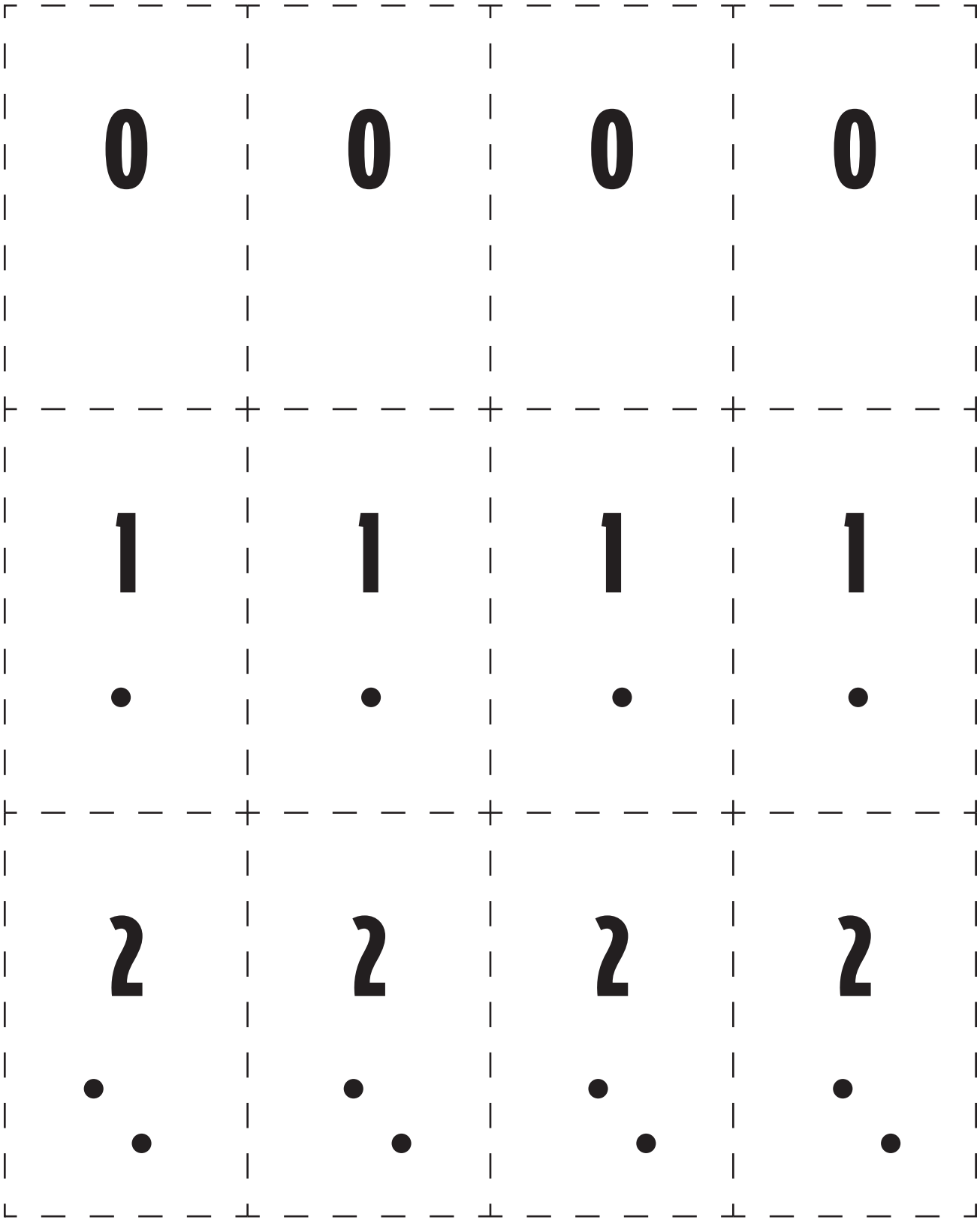
The Mailbox the Idea Magazine for Teachers, The Education Center; August/September 1997—Volume 19--Number 4—Intermediate

Web sites

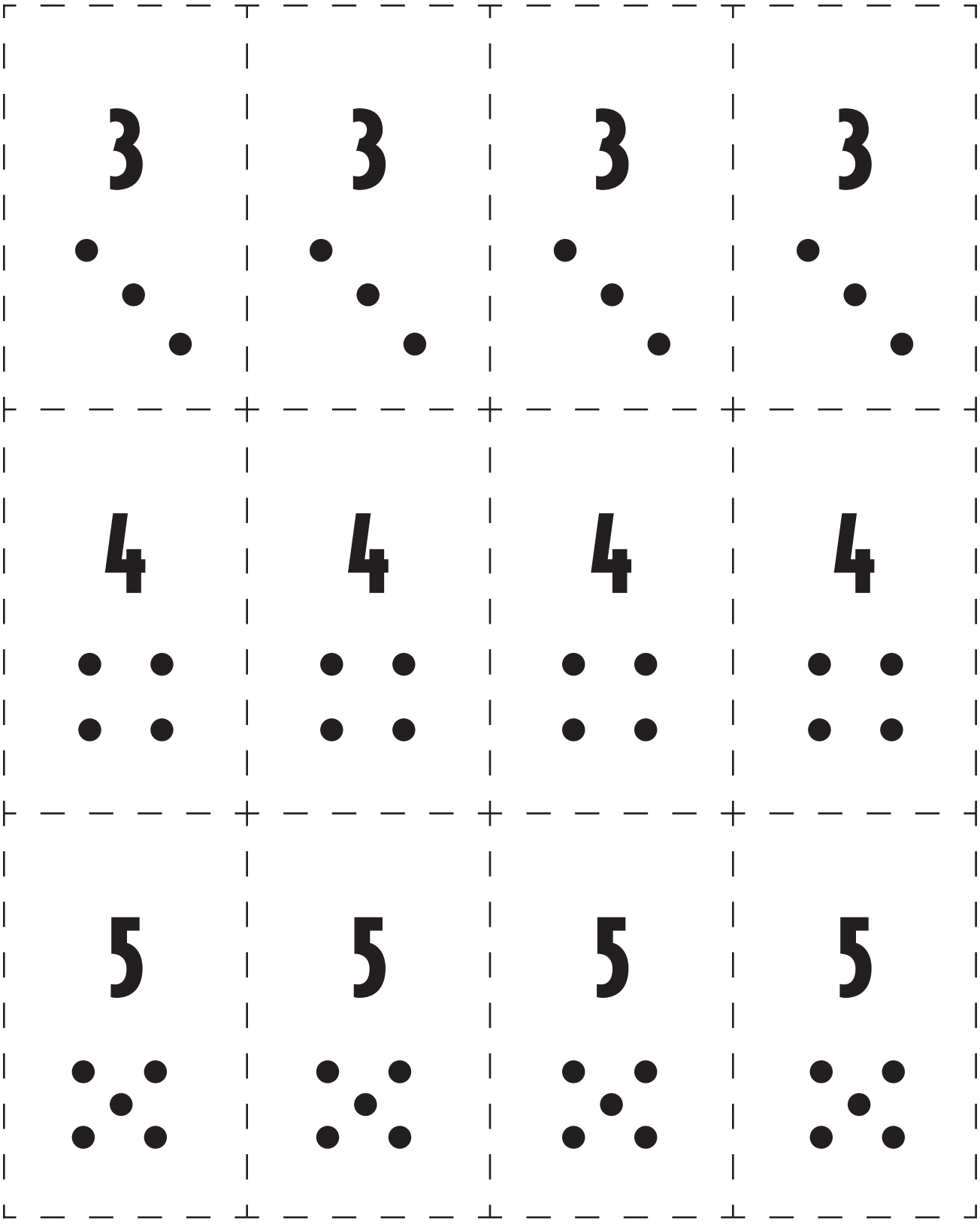
http://www.themailbox.com

http://www.mathcats.com

Digit Cards



Digit Cards



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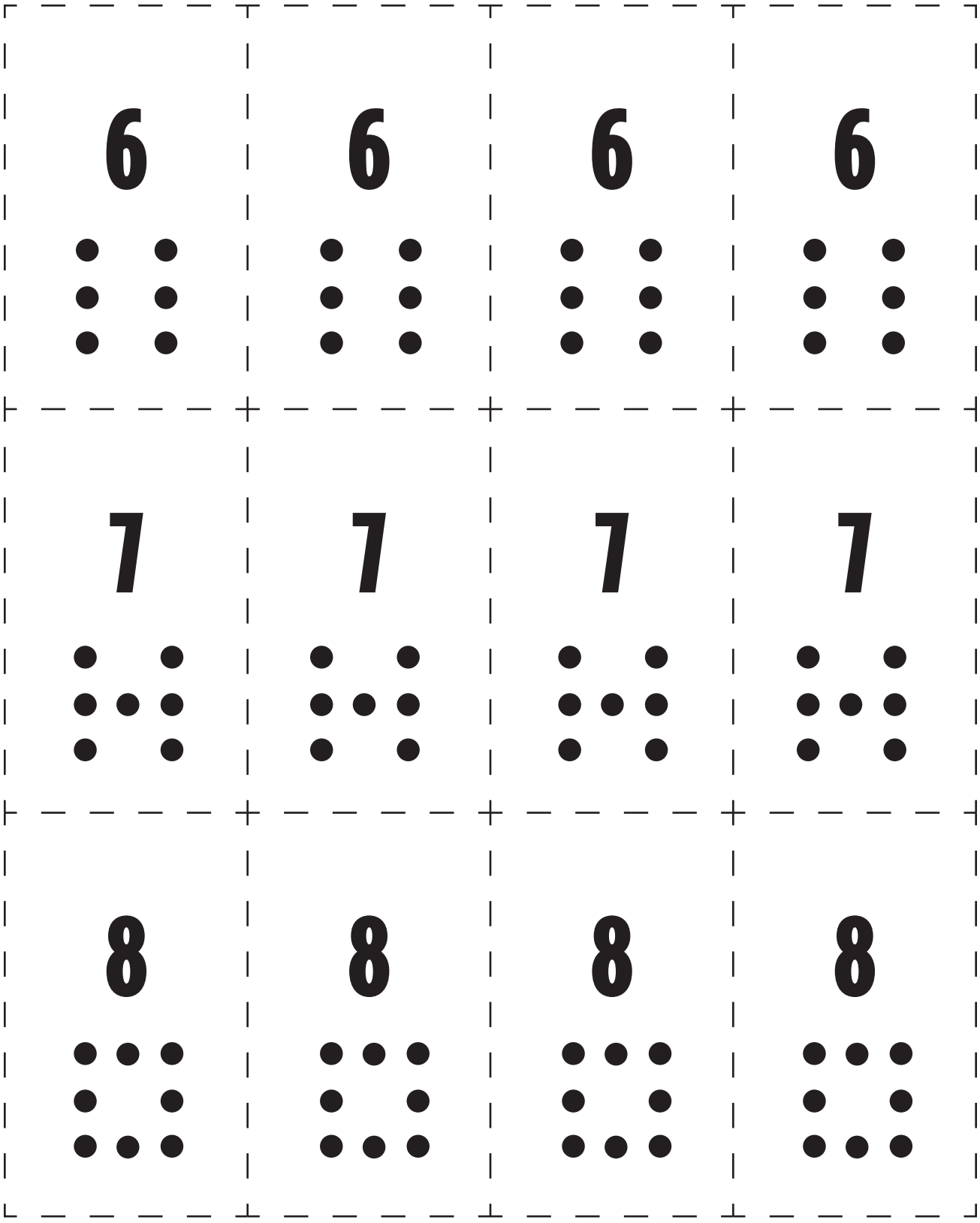

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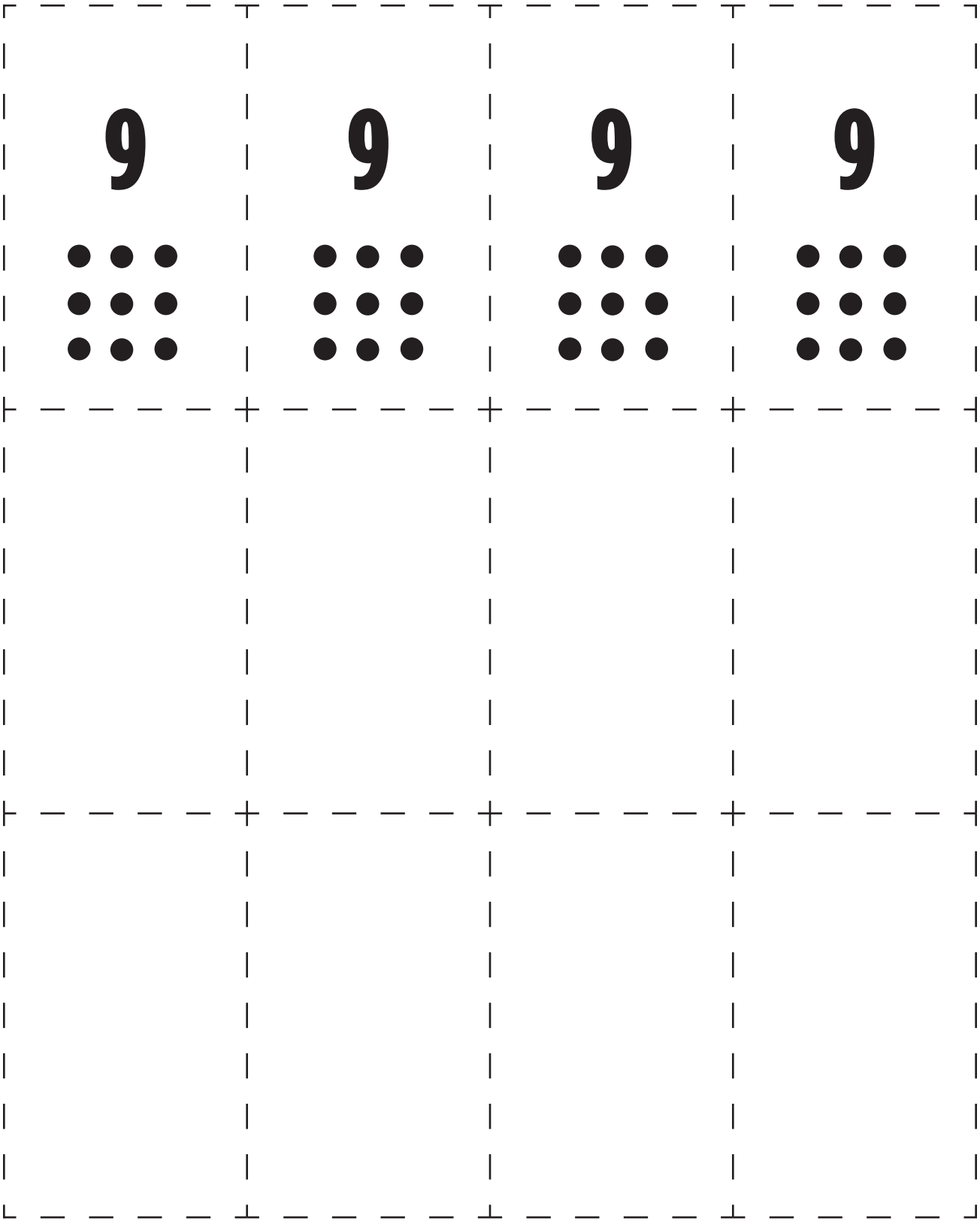


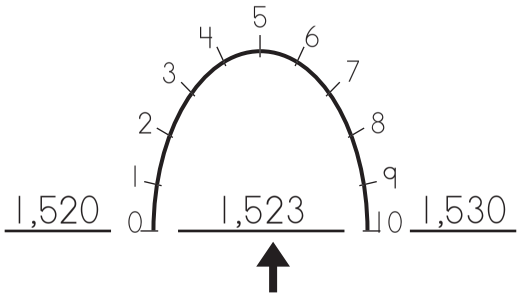
Place Value Cards

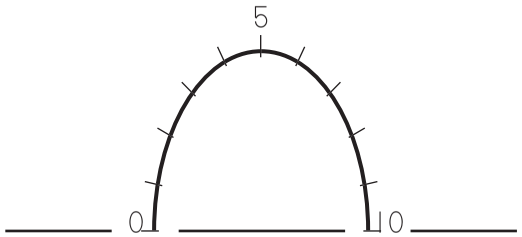
10,000s	10,000s
1,000s	1,000s
100s	100s
1s	1s

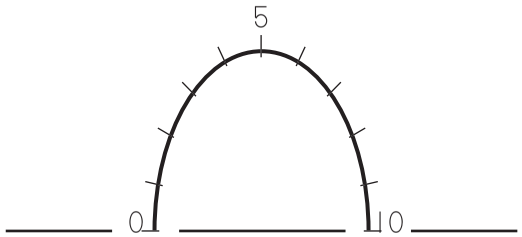
Name _____ Date _____

Rounding Mountains

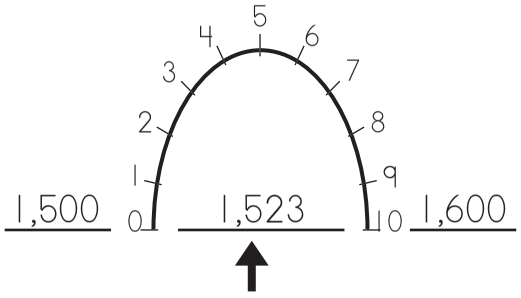
Round to the nearest 10

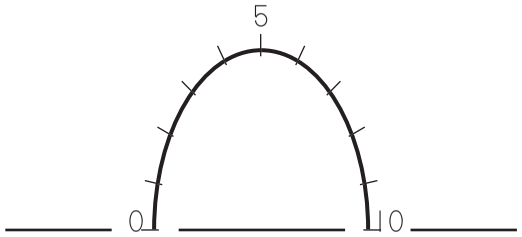


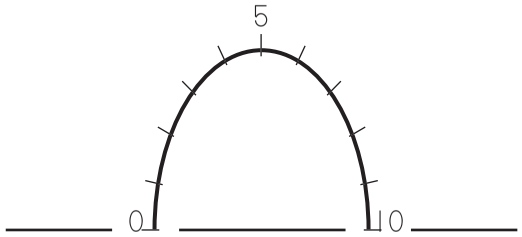




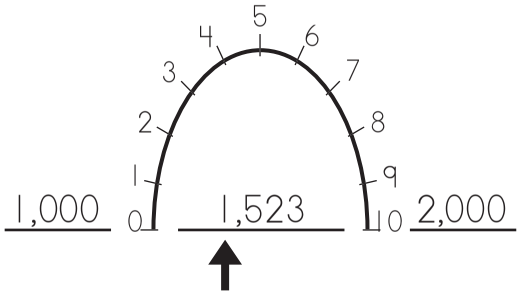
Round to the nearest 100

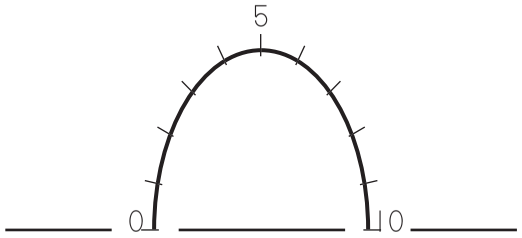


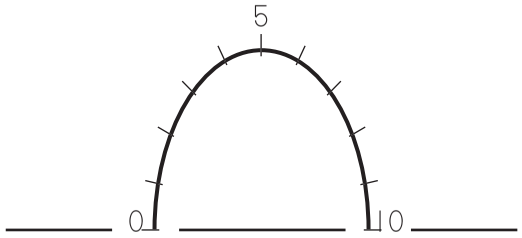




Round to the nearest 1000



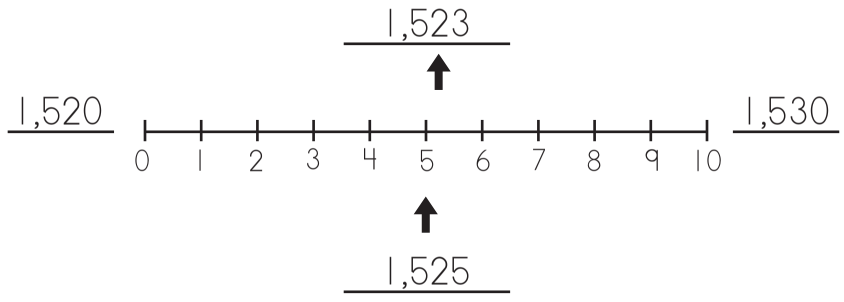


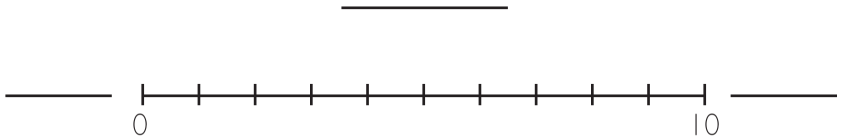


Name _____ Date _____

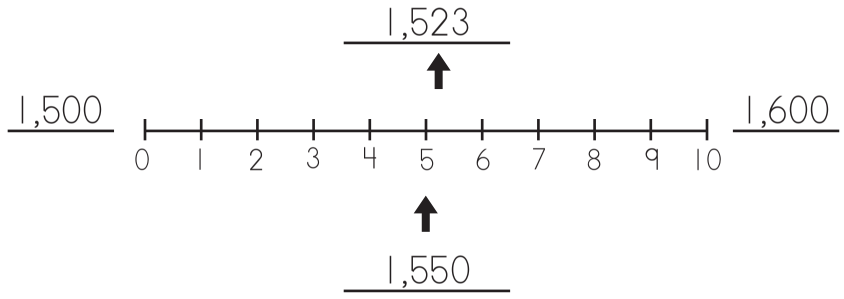
Number Lines

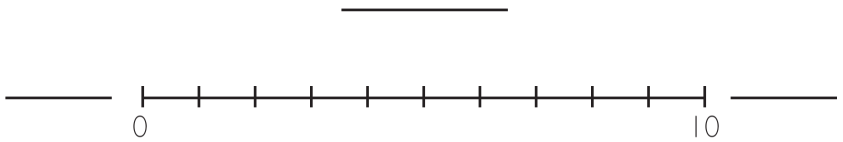
Round to the nearest 10



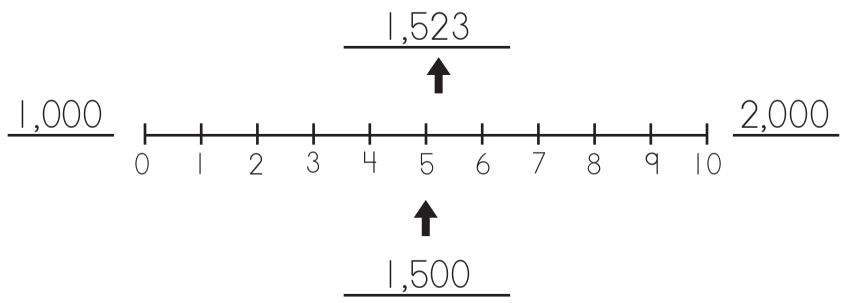


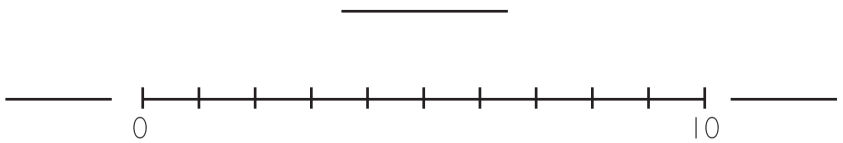
Round to the nearest 100





Round to the nearest 1000





Place Value

Math Standard I

Objective 1

Connections

Standard I:

Students will understand the base-ten numeration system, place value concepts, simple fractions and perform operations with whole numbers.

Objective 1:

Represent whole numbers up to 10,000, comprehend place value concepts, and identify relationships among whole numbers using base-ten models and symbolic notation.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
6. Represent mathematical ideas in a variety of ways.

Content Connections:

Language Arts VII-2; Listening skills
Math IV-1; Measurement

Background Information

Students should be able to know and understand what basic whole numbers are and what they look like. They should have some understanding of place value and what it represents in a whole number. They should be taught specific vocabulary relating to the lesson before you begin. This should include: Numeral, digit, standard form, expanded form, ones, tens, hundreds, thousands, ten thousands, and horizontal and vertical lines. It would be very helpful if you could show them pictures or examples of each vocabulary word listed above. They should be taught and understand how numbers are used in the world and how important the use of learning to read and write numbers is beneficial in their daily life.

Research Basis

Ball Loewenberg, D., Research on Teaching Mathematics: Making Subject Matter Knowledge Part of the Equation. Greenwich, CT: JAI Press.

In order to teach mathematics effectively, teachers must understand mathematics themselves? This articles research shows that past efforts to show the relationship of teachers' mathematical knowledge to their teaching mathematics have been largely unsuccessful. The author researches what it means to understand mathematics and the role played by such understanding in teaching.

Baxter, J. A., Woodward, J., (2005). Writing in Mathematics: An Alternative Form of Communication for Academically Low-Achieving Students. *Learning Disabilities Research and Practice*. 20(2), 119-135.

In this study they analyze how one teacher used writing to support communication in a seventh-grade, low-track mathematics class. For one school year, they studied four low achieving students in the class. Students wrote in journals on a weekly basis. Using classroom observations and interviews with the teacher, they developed profiles of the four students, capturing their participation in class discussions. The profiles highlighted an important similarity among the four students: marginal participation in both small-group and whole class discussions. However, their analysis of the students' journals identified multiple instance where the students we able to explain their mathematical reasoning, revealing their conceptual understanding, ability to explain, and skill at representing a problem.

Materials

- ❑ Place Value Stamps
- ❑ Ink Pad
- ❑ Numeral cards
- ❑ Place value block cards

Invitation to Learn

This activity is called "Match Game". Each student will receive a card. On the card there will be a numeral or place value blocks. Students will walk around and find their match. Those students with numeral cards will be looking for the person that has the same value on their card that is represented by place value blocks. Those students with place value blocks will be looking for the person that has the same value on their card but is represented by numerals. Once they have found their match they say the number with their partner. They then find another set of partners and they both share their numbers with each other. They return to their seats and write their number in their journal in standard form, expanded form and word form. They can then use their stamps to put the place value blocks for that number in their journal.

Instructional Procedures

Materials

- ❑ *Place Value Houses*
- ❑ Single digit card
- ❑ *Place Value Chart*
- ❑ White paper
- ❑ *Numeral Strips*
- ❑ Overhead markers

Places, Everyone

1. Each student should receive a copy of the *Place Value Houses*.
2. The teacher should have a copy of the *Place Value Houses* on an overhead.
3. Have students cut out their *Place Value Houses* and glue them in their journal.
4. Teach students what each house represents. The first house on the right is called Units that have the values of ones, tens

and hundreds. The second house is called Thousands with the values of ones, tens and hundreds and the third house is called Millions with the values of ones, tens and hundreds. Each house will have a group of three digits in a number. Each group is called a period. Explain to students that within each period the names are the same: hundreds, tens, and ones.

5. Write a four or five digit number on the overhead or chalkboard. (e.g. 6, 348 or 45, 823). Model how to say this number by pointing to where each number would be represented on the houses. Explain to students that when reading or writing a large numeral, it is helpful to break it down into periods and read each period as a simple one, two or three digit numeral. Also help students see that the commas between each house represent pauses when reading a numeral, just as they do in reading text. Whenever a student comes to a comma in reading or writing a large numeral, he knows to pause and say or write a period name. It is very important when you are modeling that you do not say "and" when reading the number. "And" represents a decimal, so when reading 6,348 you would not say six thousand three hundred and forty eight you would say six thousand three hundred forty eight. Model a few numbers to show students how to read large numbers. After you have modeled it a few times have students begin to say and point to the numbers that would be represented on their place value house chart.
6. Write a number on the overhead or chalkboard that has a 0 (e.g. 35, 207). Explain to students that the value of the first digit's place determines how large the numeral will be and that any empty place to the right of the digit must have a zero place holder. Read this number to the students and point to where each digit would be represented on the place value house chart. Explain that even though you didn't say anything for the zero in the tens place it is very important that they don't forget to put it in when writing the number. Each place value on any digit has to be represented by a numeral.
7. Divide the class into two groups
8. Give each student in each group a single digit card. (0-9)
9. Teacher reads a number (e.g. 12, 543) and the students arrange themselves in the proper order. Each student in the group will help each other to form the number. Once they have formed the number they raise their hand to show they have completed the number. The teacher then asks them to say the number out

loud. You can continue this activity having them create many different numbers with their cards. (See extensions for more ideas to use with this activity.)

10. After each number they create they can write that number in their journal in standard form, expanded form and word form. They can also use the place value stamps to create the number.
11. Next, you will need a *Place Value Chart* there is a black line or your students can make their own by following these simple steps.
    a. Lay a sheet of paper horizontally, fold one side in thirds and crease it and fold the other side in thirds and crease it.
    b. Open up your sheet. Draw lines along the two vertical creases.
    c. Measure and draw a horizontal line one inch from the top edge of your sheet.
    d. Beginning on the left side, label the four resulting boxes: Millions, Thousands, and Units.
    e. Measure and draw another horizontal line ½ inch below the first one.
    f. Beginning on the right side of the paper, measure and draw a vertical line 1 ¼ inches from the edge. Extend this line from the first horizontal line down to the bottom edge of the paper.
    g. Measure and draw another vertical line 1 ¼ inches from the first one. Extend this line from the first horizontal line down to the bottom edge of the paper.
    h. From left to right, label the three resulting small boxes "H" (hundreds), "T" (tens), and "O" (ones).
    i. Continue measuring and drawing vertical lines (1 ¼ inches apart) across the paper so that the thousands and millions sections are exactly like the units section.
    j. Label the three column headings ("H", "T", and "0") in each section.
    k. If you want a pocket at the bottom to hold number strips just fold the bottom up 1 ½ inches and tape or glue on each end.
12. Once they have their place value chart made you can laminate it and use overhead markers and/or use the *Place Value Strips*.
13. Read a number to them and have them place their *Place Value Strips* in the correct order to create the number provided.

14. Next have students go to a journal and write the number in standard form, expanded form, and word form. They can also use their place value stamps and stamp them in their journal to create the number given.
15. Students can work with partners and they can create numbers together or one partner can say a number and the other would create it on their place value chart.

Assessment Suggestions

- Teachers should walk around and assess the students to see if they are creating the numbers she has given them correctly.
- Students can say and point to the place value of each numeral, to the teacher, so she can see if they understand.
- Another way to assess would be to check the student's journal to see if they understand the concepts taught.
- Have students work together and assess each other's journals.

Curriculum Extensions/Adaptations/ Integration

- For advanced learners extend the place value house activity by using larger numbers and have students practice saying and writing numbers to the millions.
- Some extensions you could use with the single digit cards would be to have each group make the smallest number with their cards and then have them make the largest numbers with their cards. Next have them make a number with the value of 8 in the 10,000 place or a number with a value of 3 in the hundreds place. Have them say and write the numbers that they create.
- For advanced learners make another place value chart with four periods which include units, thousands, millions and billions. They can work with partners and create different numbers on their own.
- For students with special needs have them pair up with a partner and work together on each of the activities.
- You can extend these activities by taking two numbers and comparing the numbers. Use the symbols <, >, = and ≠. Teach the vocabulary greater than, less than, equal to and not equal to.

Family Connections

- Students can work with their parents at home by having a parent say a number and the child writes it down in standard form, expanded form and word form.
- Students can take home a copy of the *Place Value Houses* and the parent can write down a number and the child would say the number and point to the value of each numeral on the house.
- Students could take home their journal and share their place value activities with their parents.
- Parents can work with students on comparing numbers by writing two different numerals down and having the child pick the correct symbol that would go between each numeral.

Additional Resources

Articles

The Mailbox the Idea Magazine for Teachers, The Education Center; August/September 1997—Volume 19--Number 4—Intermediate

Books

Place Value (Kid Friendly Computation), by Sarah Morgan

Web sites

http://www.themailbox.com

http://www.mathcats.com

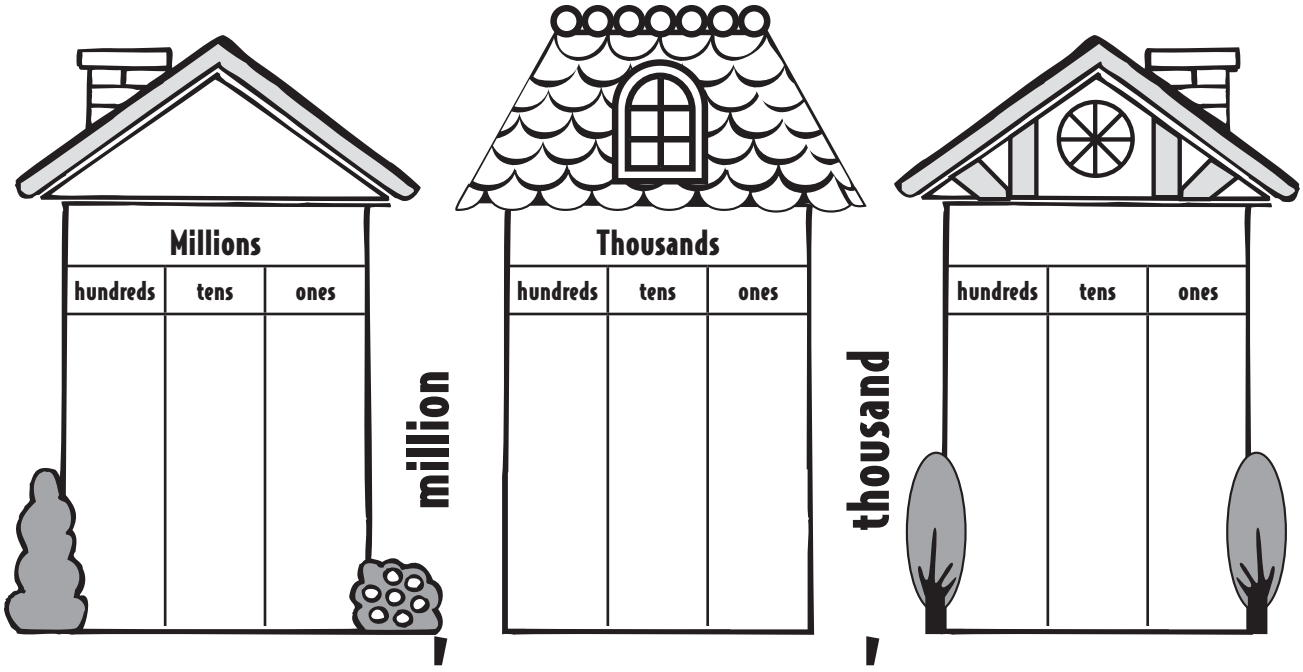
http://www.uen.org

http://lessonplanspage.com

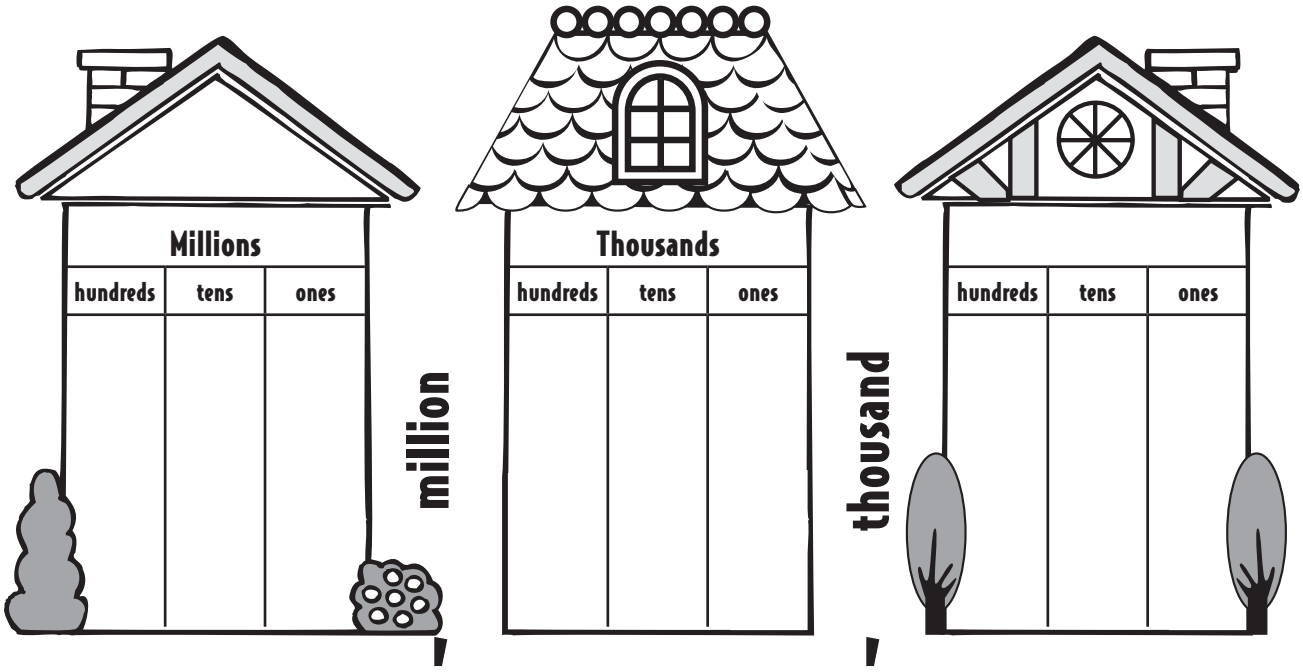
Games

Place Value Quizmo

Place Value Houses



Place Value Houses



Numeral Strips

0	1	2	3	4	5	6
7	8	9	0	1	2	3
4	5	6	7	8	9	

Science V

Activities

Heat & Light

Our Friend, the Sun

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
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Math V-1; Collect, organize, and display data

Science Standard V

Objective 1

Connections

Background Information

The sun is an average-sized star that has been burning for about 4.6 billion years. The distance from the sun's center to its surface is about 695,500 kilometers (432,000 miles), approximately 109 times the radius of Earth. The interior of the sun reaches temperatures of more than 15,000,000 degrees C, (27,000,000 F). It is a nuclear furnace producing energy, free of pollution. Although 4,000,000 tons of the sun's matter turns into energy every second, only one-billionth of the sun's light and heat ever strikes Earth.

The sun is the center of our universe. Earth and other planetary systems revolve around the sun. The sun appears to move across the sky from east to west because of Earth's counterclockwise rotation. As Earth rotates and the part of Earth we are on turns towards the sun, we see it appear to rise above the horizon. We also experience seasons and varying amounts of daylight, caused by the 23 ½ degree tilt of the Earth as it revolves around the sun. The moon does not produce any heat or light. The moon's light we experience on Earth is reflected sunlight off the moon's surface.

The sun is Earth's main source of heat and light. Heat and light from the sun's rays is called solar energy and is essential for life on Earth. The warming of Earth's atmosphere is called the greenhouse effect. Earth's climate is warming in response of atmospheric accumulation of heat-trapping gases, such as carbon dioxide (CO^2). CO^2 is produced from power plants and burning fossil fuels, and it is responsible for about half of the warming of the climate. The other main gases responsible for the greenhouse effect are nitrogen oxide

(N40) produced by automobile exhaust, methane (CH4) produced by decaying plants and animals, rotting garbage, humans and animals passing gas, chlorofluorocarbons (CFCs) found in refrigerators, air conditioners, foamed plastics, and other man-made products.

Over the past few centuries, people have been burning more amounts of fuel, such as wood, coal, oil, natural gas, and gasoline. The result, some experts believe, will be Earth heating up and undergoing global warming. Some scientists believe the build up of CO2 in the atmosphere may be caused by deforestation, which reduces the number of trees available to absorb CO2. Some solar scientists are considering whether the warming exists, wholly or in part, by a small increase in the Sun's energy output. An increase of only 0.2% in the solar output could have the same effect as doubling the carbon dioxide in Earth's atmosphere. Many fear that the rise in temperature of the Earth's atmosphere will disrupt weather patterns, causing the polar icecaps to melt and release more water into the oceans. This increase in the water level might cause the ocean's saline concentration to weaken, threatening marine species and flooding coastal areas.

Research Basis

Lasley, T.J. & Matczynski, T.J. (1997). *Strategies for Teaching in a Diverse Society: Instructional Models*

Only teachers who utilize a variety of instructional models will be successful in maximizing the achievement of all students. Teachers need to "play to" students' strengths and to mitigate students' learning weaknesses. This can be done only through the use of instructional variety.

Danielson, C., (2002). *Enhancing Student Achievement: A Framework for School Improvement*, pp. 73

Only by building and strengthening links with other institutions in the community can schools achieve their full mission. Local individuals and organizations – families and caregivers, public and private agencies, the business community, and colleges and universities – should not be regarded as competitors, but rather as partners in the education of the community's children.

Invitation to Learn

Let the Sun Shine

This activity will introduce the students to the sun as they discover how life on Earth benefits from solar energy.

Prior to this activity, you must collect the following "props" and place them in a box at the front of the room: sunglasses, teddy bear, hand fan, picture of the sun, flashlight, hand mirror, plastic stemmed flower, umbrella, Frisbee, bottle of sunscreen, "Sun", "Earth", and "Moon" nametags.

Cut apart and distribute parts from *Let the Sun Shine* master to the students. Allow them to read their parts in advance so they are comfortable with their actions and script.

Stand back and let them perform.

- As a differentiated variation, students could make their own version of this activity using a single concept from their study of the sun. They could present concepts such as "How the sun affects plant life" or "Fossil Fuels – A Gift from the Sun". Let them perform for another class or at a parents' night.

Extension

- This activity may also be used as a culminating "celebration" for their study of the sun.
- Each student will draw and label a picture representing their part from Let the Sun Shine. These pictures can be combined to make a classroom banner.
- Students will journal what they have learned about the effects of the sun.

Instructional Procedures

Materials

- ❑ *Solar Panning*
- ❑ Thermometers
- ❑ Aluminum loaf pans
- ❑ Spray paint
- ❑ Graduated cylinder
- ❑ Plastic wrap
- ❑ Tape
- ❑ Scissors

Solar Panning

We will discover the effects of heating water in different containers using solar energy. Students will discover how container size, color, and materials change the effects of solar energy. When setting up the experiment it is important to maintain constant variables except for those that are being tested. Constant (or controlled variables) would be such things as: the amount of water measured; the amount of time used conducting the experiment, the type of ground surface, etc. Manipulated (or independent) variables are those things we change in response to our intended hypothesis, such as: the size of pans, the pan's color, the pan's material, or the pan's location in relation to the amount of solar energy available.

1. Each group will need 4 aluminum loaf pans: 3 identical pans and 1 different-sized pan

2. Spray paint 2 identically-sized pans - one black and the other white, allowing time to dry.
3. Using a graduated cylinder, measure and pour 150 ml (or 2/3 cup) of lukewarm water into each of your 4 pans.
4. Place thermometers into each pan and record your initial temperature using the *Solar Panning* recording sheet.
5. Immediately cover each pan with clear plastic wrap and tape in place, leaving the thermometer inside.
6. Before placing your pans in the sun, predict how each container will absorb solar energy and record your predictions on your *Solar Panning* recording sheet.
7. Choose a level, sunny location for your pans where they should be free of human interference for a 30-minute period. Place the 2 corresponding pans together where they will receive similar solar energy.
8. Record the temperature in each pan at 10 minute intervals and observe any changes taking place on your worksheet. Replace the plastic wrap after each temperature reading.
9. At the end of 30 minutes, record your final temperature.
10. Journal and graph the results of this activity. Share your group results as you discuss the following questions.

    Did your experiment conclusions match your predictions? Why were 2 corresponding pans needed? Why were the pans covered? Did the container size matter in the collection of solar energy? How did the color of containers affect the results? How could a different location of the pan in the sunlight change the results? Would you expect to obtain the same results throughout different times of the year?

- As a differentiation activity, allow the students the opportunity to choose the containers and variables they wish as they explore the collection of solar heat. Encourage them to present their findings in unique, meaningful ways to the class.

Extension

- Use similar loaf pans of different materials (glass or plastic) and observe your results.
- Experiment with colored liquids in the loaf pans. Which colored liquid absorb more solar energy?
- Place one pan in direct sunlight and the other in the shade. Record the results.

- Cover one pan with plastic wrap and leave the second pan uncovered. What effect does the plastic wrap have on the rate of heat absorption?

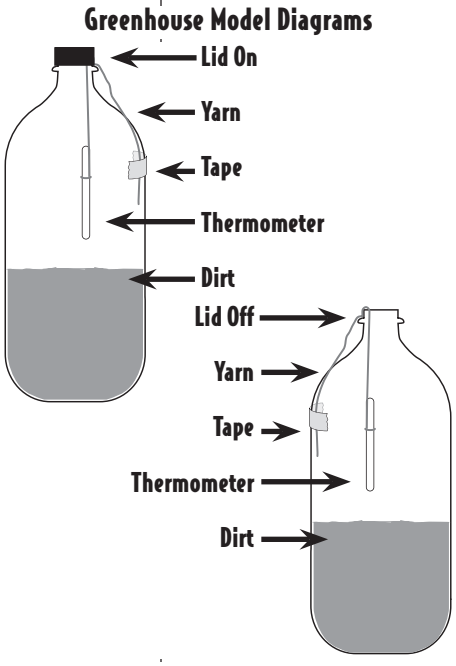
Greenhouse Model

1. Explain to the class how CO^2 is the greenhouse gas responsible for about half of the warming of our climate. If we put too much CO^2 in the atmosphere it could contribute to Earth's temperature rise. Have the class identify problems related to global warming and list them on the board.
2. Take the lid off a plastic 2-Liter bottle and place the funnel in the top.
3. Place spoonfuls of topsoil in the funnel until the bottom of the bottle has several inches of dirt.
4. Pour 2 to 3 spoonfuls of water in the funnel – just enough to moisten the soil.
5. Tie a 12 inch piece of yarn to one of the thermometers.
6. Remove the funnel from the bottle and lower the thermometer by the yarn until it is directly above the soil.
7. Tape the other end of the yarn to the outside of the bottle.
8. Replace the lid. This capped bottle will represent Earth undergoing global warming.
9. Repeat steps 2-7 using the other 2-Liter bottle.
10. Do not replace its lid. This bottle represents a planet that does not have the heat-trapping greenhouse gases.
11. Place your 2 bottles in direct sunlight.
12. Check your thermometers every 30 minutes for 2 hours and record your findings in your journal.
13. If using heat lamps instead of placing the bottles in direct sunlight, check your thermometers and record your findings every 10 minutes for 40 minutes.

Did you record the same temperature on both thermometers? Can you explain why these two temperature results are different? The open bottle allows heated gases to escape, providing a lower temperature than the bottle with the lid. The air above the open bottle is constantly changing, and as air in this bottle is heated and rises, it is being replaced by cooler air. The air in the closed bottle cannot circulate with air from the outside. The temperature of the

Materials

- ❑ 2-liter bottles
- ❑ Yarn
- ❑ Thermometers
- ❑ Potting Soil
- ❑ Water
- ❑ Spoon
- ❑ Funnel
- ❑ Tape
- ❑ Permanent Marker
- ❑ Sunny area



air in this closed bottle continues to increase as it receives more and more solar energy.

Assessment Suggestions

- Check student temperature charts, drawings, and journals for student understanding.
- Students will share activity results orally with those in their group or with the class.
- Assess student drawings and classroom banner from *Let the Sun Shine* activity.
- Use a rubric for scoring the *Solar Panning* activity.
  - 4 correct, complete, detailed
  - 3 mostly correct & complete, fairly detailed
  - 2 partially correct & complete, lacks some detail
  - 1 incorrect, incomplete, missing important detail
  - 0 no attempt

Curriculum Extensions/Adaptations/ Integration

- As a literature connection, read the book *Heat Wave* by Helen Ketteman. Have the students write and illustrate their own imaginative endings of how they could stop a heat wave. You could compile all student entries into a class book. They could also make a variation telling how they could cause a heat wave to appear during a devastating cold spell.
- After student research about the Greenhouse effect, students could write persuasive letters to businesses contributing to pollution informing them of measures they could take that would help improve air and water quality. They could write letters to government officials encouraging them to support bills and enact laws that would protect the environment.
- Students could create posters that urge people to take care of Earth.

Family Connections

- You can also demonstrate the greenhouse effect by taking 2 similar ice cubes. Place each ice cubes on a small plate. Over one of the ice cubes, place a clear, plastic cup. Leave the other

cube uncovered. Set them both in direct sunlight. Observe the melting rate of each ice cube. Which ice cube melted more rapidly? Explain how the melting of the covered ice cube demonstrates the greenhouse effect?

- Ask the students if they have ever sat inside a parked car in the sunlight with the windows closed. The heated air from the sunlight gets trapped inside the car. This is an example of the greenhouse effect. Remind students how dangerous this can be on a hot day. The temperature inside a closed car can reach over 120 degrees F (49 degrees C) in a matter of minutes.

Additional Resources

Books

Energy Makes Things Happen, by Kimberly Brubaker Bradley (Let's-Read-and-Find-Out Science); ISBN 0-06-445213-1

Experiments With the Sun and the Moon, by Salvatore Tocci (A True Book Series); ISBN 0-516-22605-3

Heat Wave, by Helen Ketteman; ISBN 0-8027-7577-2

Sun, by Dana Meachen Rau; ISBN 0-7565-0440-6

The Sun, by Dan Elish (Space Group 2); ISBN 978-0-7614-2048-4

The Sun, by Margaret J. Goldstein (Lerner Publications Company); ISBN 0-8225-4647-7

The Sun: Our Nearest Star, by Franklyn M. Branley (Let's-Read-and-Find-Out Science); ISBN 0-06-445202-6

The Sun, by Isaac Asimov (Isaac Asimov's 21st Century Library of the Universe); ISBN 0-8368-3242-6

What if the Polar Caps Melted? by Katherine Friedman (What If? Series); ISBN 0-516-23914-7

Media

All About Light, Physical Science for Children Series, (Schlessinger Science Library) Library Video Company VHS DK7109, DVD DV8854

Bill Nye the Science Buy Series Three – The Sun, (Disney Educational Productions) Library Video Company VHS DN2248, DVD DW0599

All About the Sun – Space Science for Children, (Schlessinger Science Library) Library Video Company ISBN 1-57225-234-0

Web sites

The Sun: Man's Friend & Foe, http://library.thinkquest.org

NASA Explores Just For Fun, http://www.nasaexplores.com/fun.php

Windows to the Universe – Beginner Fun & Games, http://www.windows.ucar.edu/

NASA's Observatorium, http://observe.arc.nasa.gov/nasa/core.shtml.html

Stanford's Solar Center, http://solar-center.stanford.edu

National Arbor's Day Foundation Carly's Kids Corner, http://www.arborday.net/kids/carly/

Let the Sun Shine

Materials Needed:

- Large box
- Sunglasses
- Hand Fan
- Teddy Bear
- Sun Picture
- Flashlight
- Hand Mirror
- Frisbee
- Umbrella
- Sunscreen
- Stemmed Flower
- Nametags for "Earth" "Sun" "Moon"

#1 Skip to the front of the room, take a deep bow, and yell, *"We would like you to meet our hero, the Sun."* Then skip back to your seat.	#2 When you hear someone say, "Our hero, the sun," run to the classroom door and look out into the hallway. Place your hand horizontally above your eyes as if looking far away and yell, *"Where is the sun?"* Then give a puzzled look, scratch your head, and return to your seat.
#3 When someone asks, "Where is the sun?" flap your arms like a bird as you fly towards a window and yell, *"Everyone knows you can find the sun outside!"* Chirp like a bird as you fly back to your seat.	#4 When someone chirps and flaps their arms like a bird, run to the box, take a pair of sunglasses out, and run to the right side of the room. Put the sunglasses on and ask, *"Why is the sun so bright?"* Do ***not*** return back to your seat.
#5 When you see someone wearing sunglasses, run to the box and find a fan. Run to the left side of the room, fanning yourself and ask, *"Why does the sun feel so hot?"* Continue fanning yourself. Do ***not*** return back to your seat.	#6 When you see someone fanning themselves, come to the front of the room carrying your chair. Find the teddy bear in the box. Stand on your chair, snuggling the bear and ask, *"Where does the sun go at night?"* Continue standing on your chair with your bear. Do ***not*** return back to your seat.

#7

When you see someone holding a teddy bear, walk proudly to the front of the room taking bows. Find the picture of the sun in the box. Hold it high above your head and yell, *"I am the sun. Listen to my story as I answer all of your questions. Come with me!"* Place the picture of the sun on the chalkboard and lead the 3 kids back to their seats.

#8

When you see someone place a picture of the sun on the chalkboard, slowly walk to the front of the room wiggling the fingers of both hands high above your head. Write the words, *"A STAR"* in large letters on the chalkboard and say, "*The Sun is a medium-sized star. It appears bigger and brighter than other stars because it is so close to the Earth."* Return to your seat walking passed the front row of students. Lean very close to each one and whisper the words, *"Close, close, close . . ."* over and over.

#9

When you see someone write the words "A STAR" on the chalkboard, run to the front of the room. Find the "Sun" nametag and a flashlight in the box. Put it on, turn on the flashlight, and shine it towards the class. Yell the words, *"The sun is like a huge furnace of burning gases. Hydrogen is the sun's fuel."* Continue standing there. Do *not* go back to your seat.

#10

When someone says, "Hydrogen is the sun's fuel", stand where you are and yell, *"The temperature inside the sun reaches millions of degrees, much hotter than any place on Earth."* Wipe one hand across your forehead and say, *"Is anyone else feeling a little toasty in here?"* Sit back down.

#11

When someone asks, "Is anyone else feeling a little toasty I here?" spread your arms out like the wings of a spaceship, lower your head, and fly toward the "Sun" making loud rocket sounds. When you reach the "Sun", stop and yell, *"The sun is so hot that a spaceship would be instantly destroyed by its intense heat before it could even get close."* Then act like a melting candle as you shrink in size repeating the words, *"I'm melting! I'm melting!"* Return to your seat.

#12

When someone says, "I'm melting! I'm melting!" run to the front of the room. Find and put on the "Earth" nametag. Stand about 5 feet away from the "Sun" and yell, *"The Sun is the center of our solar system. The Earth is one of the 9 planets that orbit, or circle the sun."* Do *not* go back to your seat.

#13

When someone says, "The Earth is one of 9 planets that orbit the sun," stand where you are and yell, *"Although the Earth is 93 million miles away from the sun, it still receives the sun's energy. This energy comes to us as heat and light."* Sit back down.

#14

When someone says, "This energy comes to us as heat and light," gallop around the perimeter of the room. When you reach to the front of the room, stop and yell, *"The Earth travels, or revolves, around the sun in a path called an orbit. One complete orbit makes a year, about 365 days on Earth. That's a pretty long trip!"* Gallop back to your seat.

#15

When someone gallops back to their seat, carefully come to the front of the room, spinning yourself round and round. When you reach the front, put one finger on top of "Earth's" head and slowly spin them around several times. Stop "Earth" and yell, *"The Earth spins, or rotates, as it orbits around the sun. One complete rotation takes 24 hours on Earth, making a day. Our Earth never stops spinning!"* Return to you seat spinning around.

#16

When someone says, "Our Earth never stops spinning," stand on your chair and crow loudly like a rooster flapping your arms. Then yell, *"For 12 hours one side of the Earth faces the sun. During these daytime hours we can see the sun's light and feel its heat."* Crow once again like a rooster and sit down.

#17

When someone crows like a rooster and sits down stand on your chair and loudly whoo, whoo, whoo like an owl. Then yell, *"As the Earth rotates the next 12 hours, it faces away from the sun. During these nighttime hours the sun's heat or light does not reach that side of the Earth."* Whoo once again like an owl and sit down.

#18

When someone whoos like an owl and sits down, run to the front of the room. Find the mirror and the "Moon" nametag and put it on. Stand beside the "Earth" holding the mirror so it faces the "Sun" and yell, "*The moon does not produce any heat or light of its own. Light from the sun reflects, or bounces off the moon's surface like a mirror."* Look up above the "Moon" and say, *"Did I just spy a leaping cow?"* Make "mooing" sounds like a cow and stampede back to your seat.

#19

When someone "moos " and runs like a cow back to their seat, run to the front of the room, do a cartwheel, and yell, *"We know how the Earth and the moon receive the sun's energy; but how does its heat and light helps us?"* Motion toward the "Sun", "Earth", and "Moon" with your hand for them to follow you and say, *"Empty your hands and return to your seats."* Do another cartwheel and together return to your seats.

#20

When you see someone doing a cartwheel as they return to their seat, run around the classroom yelling, *"Our sun is continually producing solar energy that is sent out into space. It will continue radiating heat and light for millions of years. Unlike me, it never gets tired of working."* Stop running and slowly crawl back to your seat.

#21

When you see someone crawling back to their seat, run to the front of the room, curl up in a small ball, and slowly stretch upward like a seed growing towards the sun. Then yell, *"The sun's heat and light helps green plants grow. The green plants store some of the sun's energy in their leaves as food."* Spread your arms out and lazily float like a leaf back to your seat.

#22

When someone says, "Green plants store some of the sun's energy in their leaves as food," crawl like an inchworm arching your back to the right side of the room and yell, *"Animals get their energy by eating green plants. Caterpillars nibble leaves, taking in the stored solar energy from the green plants they eat as food."* Crawl like an inchworm back to your seat.

#23

When you see someone crawling like an inchworm, hop to the left side of the room like a frog saying "Ribbit, ribbit, ribbit . . ." Then yell, *"Many animals eat one another for food. Each animal receives some of the stored energy from the sun as a part of the food chain."* Return to your seat hopping like a frog.

#24

When you see someone hopping like a frog, dance to the front of the room and say, *"The food people eat comes either from plants or animals. This way we also receive some of the sun's energy that was stored in all of the fruits, vegetables, and meats we eat. We should thank the sun every time we enjoy a good meal."* Dance back to your seat.

#25 When you see someone dancing back to their seat, carefully stand on a table in the room and roar like a dinosaur. Then yell, *"Millions of years ago when dinosaurs roamed the Earth, it was covered with swamps and jungles. As these plants and animals grew they stored solar energy."* Roar again like a dinosaur but do *not* return to your seat. Wait and follow the person making car sounds back to your seat.	#26 When you see someone roar like a dinosaur, walk to the front of the room and find the flower in the box. Walk over to the "dinosaur", hold the flower in front of you, and sadly say, *"When the dinosaurs died, they slowly changed to coal, oil, and natural gas. Today, we use the stored-up solar energy in the fossil fuels that run our cars, airplanes, and rockets."* Make the sound of a car engine and drive yourself back to your seat.
#27 When you see someone making car noises and driving back to their seat, form a big circle with your outstretched arms, blow air as you twirl around like a tornado around the room. When you reach the back of the classroom, stop and yell, *"Our weather and climate depend upon the sun. As the sun's heat warms the Earth's land and oceans, heated air rises, causing winds."* Twirl your way back to your seat.	#28 When you see someone twirling like a tornado, run to the front of the room, find and open the umbrella, and yell, "*Water vapor rises into the air as the sun heats oceans and lakes. When this moisture cools, it returns to the Earth as rain, snow or hail. The Earth's water cycle provides needed moisture for all living plants and animals."* Close the umbrella and return to your seat.
#29 When you see someone close an umbrella, run to the front of the room with a partner, take the Frisbee in the box, and run to the right side of the room. When your partner has run to the left side of the room, toss the Frisbee back and forth with them as you say, *"We all enjoy the sun's warmth and light as we play outdoors."* Wait until your partner has finished their part. Then return the Frisbee and return to your seat.	#30 When you see someone close an umbrella, run to the front of the room with a partner, find the sunscreen in the box, and run to the left side of the room. Toss the Frisbee with your partner as they say their part. Then put some sunscreen on your face and yell, *"We must remember that the sun produces harmful UV rays that can damage our skin. Wearing proper clothing and sunscreen helps protect us from harmful UV rays when we are exposed to the sun's light for long periods of time."* Return the sunscreen and return to your desk.

#31 When you see Frisbee players return to their seat, run to the front of the room and yell, *"For millions of years, the sun has warmed and lighted our planet. It will continue shining bright and warm for many more millions of years, providing the energy needed for all living things."* Take a deep bow and return to your seat.	#32 When you see someone take a deep bow and return to their seat, stand up where you are and yell, *"Let's all stand up and cheer loudly, as we thank our hero, the Sun."* Everyone stands and goes crazy cheering.

Name _____ Date _____

Solar Panning

Question: How will varying the size of pans affect the rate of solar heat absorption?

Hypothesis: I think _____

_____

Record the temperature of the water in both pans as you first place them in the sun. Then continue to record the temperature of the water in your pans every 10 minutes.

	Small Pan	Larger Pan
Time	Temp.	Temp.
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

What is your conclusion? _____

_____

Question: How will varying the color of the pans affect the rate of solar heat absorption?

Hypothesis: I think _____

_____

	White Pan	Black Pan
Time	Temp.	Temp.
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

What is your conclusion? _____

_____

In which pan did the water temperature increase the most? _____

What would be the most effective size and color for a solar heat absorption container? Why?

_____

_____

Managing Heat

Standard V:

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

Objective 1:

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

Intended Learning Outcomes:

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

Content Connections:

Math V-1; Collect, organize, and display data

Science Standard V

Objective 1

Connections

Background Information

Something that is hot, like a hot drink, feels very different from something cold, like ice cream. Both sensations are caused by the same thing: heat. The difference is that the cold object contains less heat than the hot ones. Our bodies make heat from our food. We also get heat from the Sun and from burning fuels. The heat of an object is measured using temperature. A thermometer measures temperature.

Many students have the misconception that a coat or glove can produce heat. Heat is the flow of energy from hotter to cooler objects. Coats and gloves help stop the flow of energy and trap, or hold the heat. Insulators are materials that block the flow of heat, so warm things tend to stay warm while cold items stay cool longer. Good insulators are plastic, feathers, air, and materials that hold air. Heat conductors are materials that allow the flow of heat energy to move easily from one source to another. Good conductors are solid materials such as metals.

The body of a polar bear is made for living in its harsh, cold environment. Among land animals, the polar bear is the largest predator in the world, with an average male measuring about 8 feet long and weighing between 800 to 1300 pounds. Large bodies usually hold heat much better than smaller ones. But the bear's large body also has extra layers of protection against the cold. Although a polar bear looks white, its skin is black, and its hair has no color at all. Its thick coat is really two layers of fur: a waterproof undercoat of short hair and a layer of guard hair 6 inches in length. Each hair is really a hollow tube that you can see right through. Some of the sunlight bounces

off the hair, making the bear appear white; but most of the sun's rays pass through the hollow hairs and are trapped by the bear's black skin. Underneath this fur coat, the polar bear has a layer of fat that can be 4 inches thick. The polar bear can survive even when the outside temperature drops to -70 degrees F because this fat and layers of fur act as insulators, trapping its body heat.

Research Basis

Tomlinson, C.A. (1999) *The Differentiated Classroom, Responding to the Needs of All Learners* pp7-8.

Differentiated classrooms feel right to students who learn in different ways and at different rates and who bring to school different talents and interests. More significantly, such classrooms work better for a full range of students than do one-size-fits-alls settings. Teachers in differentiated classrooms are more in touch with their students and approach teaching more as an art than as a mechanical exercise.

Kesidou, S. & Roseman, J. E., (2002), *How Well Do Middle School Science Programs Measure Up?* Findings from Project 2061's Curriculum Review.

Programs rarely provided students with a sense of purpose for the units of study. This program took account of student's beliefs that interfere with learning. It modeled the use of scientific knowledge so that students could apply what they learned in everyday situations.

Floden, R. A., Buchmann, M., and J. Schwille, J., (1987). *"Breaking with Everyday Experiences"* Teachers College Record 88, p. 263.

Representations of the subject need to take into account what learners are already likely to know and understand about the subject matter as well as the experiences and knowledge they bring with them from their environment.

Invitation to Learn

Pass the Penny

Heat is the flow of energy from hotter to cooler objects. Temperature is a measure of how much heat energy an object has.

Prior to this activity, mark a penny with a small, flat dot of fingernail polish. Provide each group of 4 or 5 students with a small cloth bag containing 5 pennies. Have a member of the group remove the marked penny and hold it for approximately 10 seconds in their closed fist. Quickly pass the penny on to the next group member, allowing them to hold the penny for about 10 seconds. Continue this process until the penny has gone around the group once or twice. (You may notice that the penny has become warm). Replace this

penny quickly with the others in the bag and shake them up. Ask a volunteer to reach into the bag and pull out the marked penny. How could they recognize which penny to choose? Why did this penny feel different than the others? What was the penny's heat source? What causes the temperature change of the penny? You might also try this activity by allowing the marked penny to lie in direct sunlight (or under a heat lamp) for 30 seconds, and repeat the activity. Were the results similar?

- As a differentiated variation, students could choose the objects put into the bag for this activity according to their understanding of materials as heat conductors. They could also vary the number of objects used.

Materials

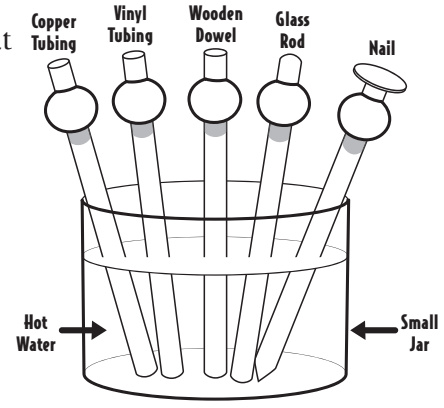
- ❑ *Race Some Beads*
- ❑ Glass jars
- ❑ Plastic beads
- ❑ Nail
- ❑ Wooden dowel
- ❑ Vinyl Tubing
- ❑ Copper Tubing
- ❑ Glass Rod
- ❑ Butter
- ❑ Plastic Knife
- ❑ Plate
- ❑ Timer
- ❑ Plastic Beaker
- ❑ Hot water

Instructional Procedures

Race Some Beads

This activity will demonstrate how well some materials conduct heat.

1. Cut the wooden dowel, copper tubing, and vinyl tubing to lengths of 4 inches.
2. Attach one bead on the end of the glass rod, nail, and the 3 types of tubing using a small dab of butter. The beads should be attached using similar amounts of butter and the same distance from the end of each rod.
3. Stand each rod up in a small glass jar so the bead on each rod is extending out of the container.
4. Each rod will act as a conductor of heat. Predict the order of rod materials as heat conductors on your *Race Some Beads* recording sheet.
5. Pour hot water in the glass jar and begin a timer.
6. Heat will move from the water, into each rod, and melt the butter. The bead that falls first was attached to the best heat conductor.
7. Record the amount of time it takes for each bead to fall.
8. Compare the activity results to your prediction.
9. Complete the *Race Some Beads* recording sheet showing the results of your learning and attach it into your journal.



Materials

- ❑ Jars with lids
- ❑ *Bottling Heat*
- ❑ Aluminum foil
- ❑ Cork
- ❑ Scissors
- ❑ Tape
- ❑ Thermometers
- ❑ Timer
- ❑ Hot water

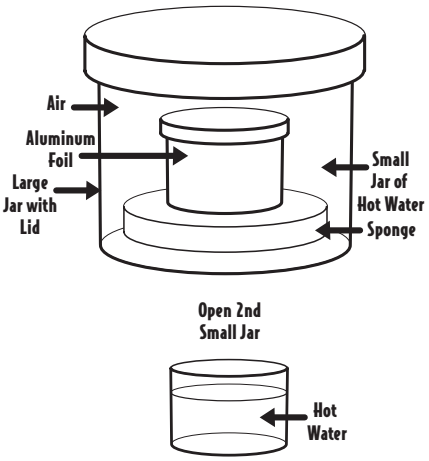
Bottling Heat

1. Wrap two layers of aluminum foil tightly around one of the small jars with the shiny side of the foil facing in.
2. Fasten the foil to the bottle with tape.
3. Place the cork in the bottom of the larger jar.
4. Fill both of the small jars with hot water of the same temperature.
5. Record the temperature of the water in these jars in your journal.
6. Place the lid on the small jar wrapped with foil. Do not put the lid on the other small jar.
7. Place the closed jar in the bottom of the larger jar, standing it on the cork.
8. Put the lid on the larger jar.
9. Leave the other small, open jar exposed to the air.
10. After 5 minutes, take the small jar out of the larger jar, open the lid, and record the water temperature.
11. Record the temperature of the water in the open jar.
12. Repeat steps 6-9. Wait 5 minutes and record the temperature of both jars.
13. Repeat steps 6-10 once again and take a final reading.
14. Draw and graph your results using the *Bottling Heat* worksheet. Attach it in your journal.
15. Compare the difference in the temperature of the two bottles and explain your results in your journal.

    What happened to the temperature of the water in the open jar? Where did the heat go? What has insulated the water in the closed inner jar?

    Heat does not pass easily through the insulated jar, the cork, and the air in the large jar. Water in the open jar loses heat more quickly. A Thermos flask keeps drinks hot or cold. It is made using two containers with a tight lid, like your heat store. The inner container has shiny sides and a double wall with a "vacuum" or empty space inside. It is so difficult for heat to leave or enter the flask that its contents stay hot, or remain cold, for a long time.

- You may wish to use this differentiated variation for this activity. When students have a good knowledge of how



materials can be used as insulators, they could design their own insulating devises. Allow them to select containers and insulating materials they wish to use. You could allow them to choose different substances to test, rather than hot water.

Polar Padding

1. Have the students collect materials they feel could be used as good heat insulators.
2. Trace both sides of the polar bear on a piece of lightweight Pellon (9 in. X 11 in.) using the *Polar Padding Pattern*.
3. Fold the bear to form a pocket.
4. Sew 2 sides of the bear using large eyed quilting needles and yarn or string. Leave the mouth end of the bear unsewn for stuffing.
5. Students may insulate their bear choosing 3 layers of material.
6. Place a thermometer inside their bear. Allow a few minutes and take the temperature of their insulated bear and record it in their journal.
7. Pour hot water into a Ziplock bag and place this "body" inside the bear on top of the thermometer.
8. After a few minutes record the bear's new temperature.
9. Place your bear in its cold environment. You could take it outside on a cold, wintery day, place it in a freezer, or place it between two large zip-lock bags containing ice.
10. Record the temperature of your bear every 5 minutes for 15 minutes.
11. Graph and journal the results of the activity. Compare your findings with bears insulated using different materials.

Materials

- ❏ *Polar Padding*
- ❏ Pellon interfacing
- ❏ Various Insulating Material
- ❏ Quilting needles
- ❏ Yarn
- ❏ Thermometers
- ❏ Ziplock bags
- ❏ Ice
- ❏ Hot water

Assessment Suggestions

- Check student temperature charts, drawings, and journals for student understanding.
- Students will share activity results orally with those in their group or give a presentation to the class.
- Use a rubric for scoring the *Bottling Heat* activity.
  - 4 correct, complete, detailed
  - 3 mostly correct & complete, fairly detailed
  - 2 partially correct & complete, lacks some detail

1 incorrect, incomplete, missing important detail

0 no attempt

Curriculum Extensions/Adaptations/ Integration

- This activity could be adapted for a small group with each member selecting an insulating material. They could collectively construct their body, each contributing their insulating layer. Their group findings could be recorded and compared with other group results.
- Select a variety of warm-blooded animals from various biomes: whale, walrus, lion, kangaroo mouse, wolf, etc. Identify how the insulating layers of these warm-blooded animals help to maintain a constant body temperature. Construct a body using insulating materials for one of these animals following the procedures above and record your findings.
- As a differentiated activity, replace the polar bear with a picture of a lizard or another cold-blooded animal. Fill the baggie for the body of this animal with water at room temperature. Place materials inside its body that will act as heat conductor. Place our lizard in the sun or under a heat lamp. Record the temperature every 5 minutes as it absorbs the sun's heat. Place your lizard in the shade and record the temperature changes showing how it retains body heat.
- After reading the book *The Magic School Bus in the Arctic* by Joanna Cole as a class, each student would research on a polar animal and how layers of their body act as insulators against freezing Arctic temperatures. Posters displaying their findings could be shared and assessed.
- Have the students construct a class quilt. What considerations should be made it choosing the materials for their quilt? How does the weight of the batting and the fabric affect the quilt's efficiency for retaining body heat?

Family Connections

- Have students visit a local sporting goods store to observe and compare the weight, efficiency, and cost of various sleeping bags. What materials were used as insulators and how are they constructed?

- Using the Thermos company website, research what materials are used in making Thermos bottles and coolers. How can you select the best product when comparing product use and its efficiency?
- Looking at labels, identify the materials used in students' winter clothes: coats, mittens, boots, etc. Compare them to the materials used in summer clothing. Determine which are made using natural fibers compared to man-made products.
- Compare the materials used as handles, lids, and cooking surfaces of pans in your kitchen. When are heat conducting materials used, and when is it important that the material serve as heat insulators.

Additional Resources

Books

Cold, Colder, Coldest, by Michael Dahl (Animal Extremes Series); Children Library Resources Item #GK923763

Experiments with Heat, by Salvatore Tocci (A True Books Series); ISBN 0-516-22510-3

The Magic School Bus in the Arctic, by Joanna Cole; ISBN 0-590-18724-4

Temperature, by Brenda Walpole (Measure Up With Science); ISBN 0-8368-1363-4

Temperature, by Navin Sullivan; ISBN 918-0-7614-2322-5

Polar Bears, by Ann O. Squire (A True Books Series); ISBN 0-516-25473-1

Polar Bears, by Julia Barnes (100 Facts About Predators); ISBN 0-8368-4038-0

Polar Bears, by Timothy Levi Biel (Zoobooks); ISBN 0-88682-414-1

Media

Heat, Bill Nye the Science Guy Series Three, (Disney Educational Productions) Library Video Company VHS DN2226, DVD DW0577

Heat, The Way Things Work Video Series, by David Magaulay (Schlessinger Media) Library Video Company VHS DK7849, DVD DV6014

Animal Adaptations, (Discovery Channel School Series) Teacher's Media Company VHS TBRR-354074

Web sites

Kids Saving Energy, http://www.eere.energy.gov/kids/

Science NetLinks, http://www.sciencenetlinks.com

The Sun: Man's Friend & Foe, http://library.thinkquest.org/15215/

Thermos Company, http://thermos.com/technologies.aspx

Coleman Company, http://coleman.com

Name _____ Date _____

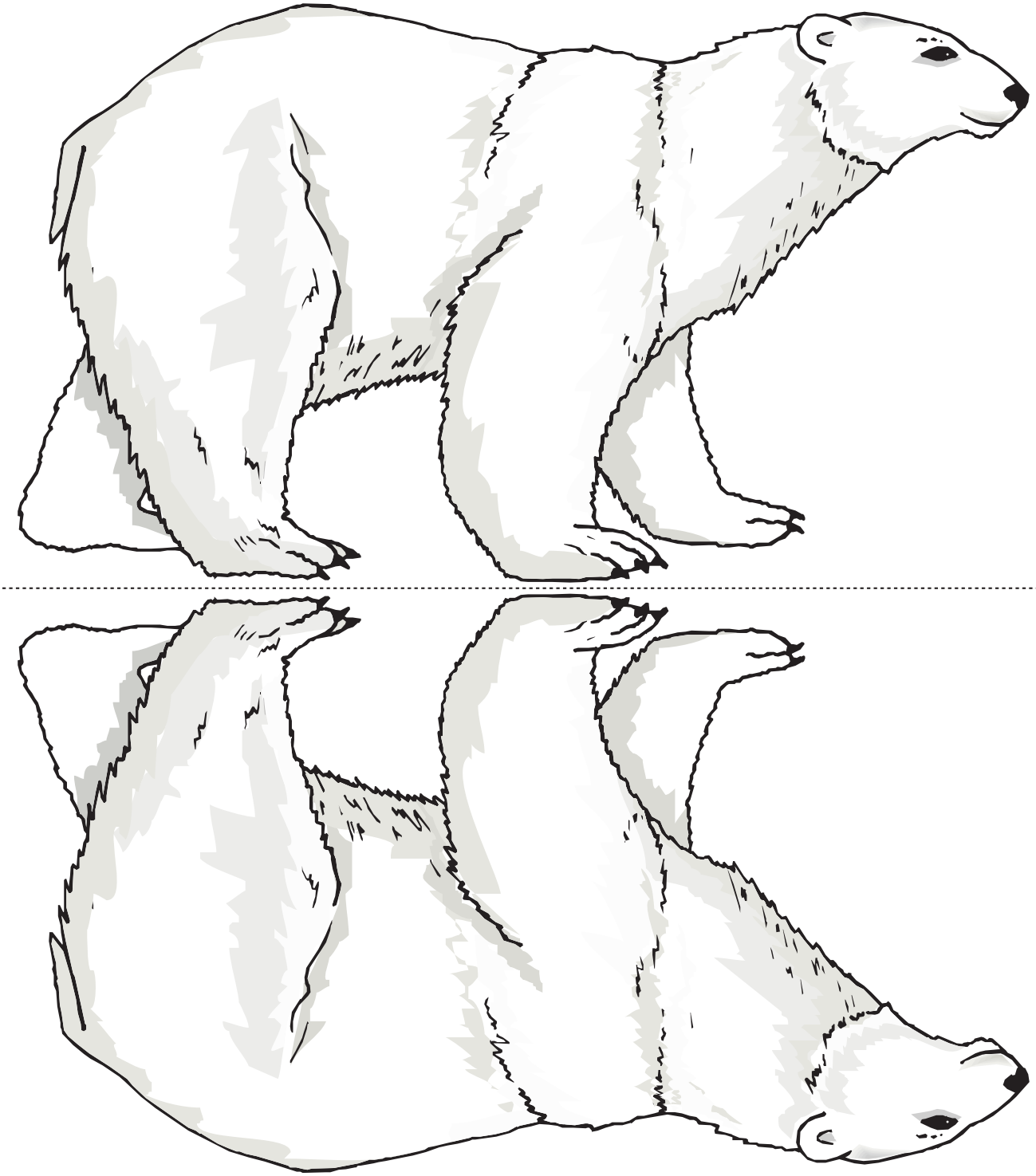
Race Some Beads

Items	Predict	Time	Result	

Name _____ Date _____

Bottling Heat

Polar Padding Pattern



Math IV-1&2

Activities

Measurement

To an Inch and Beyond!

Standard IV:

Students will select and use appropriate units and measurement tools to solve problems.

Objective 1:

Select and use appropriate tools and units to estimate and measure length, weight, capacity, time, and perimeter of two dimensional figures.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.

Content Connections:

Social Studies V1-1; Use grids, scales, and symbols.

Math Standard IV

Objective 1

Connections

Background Information

Students need to have a good understanding of why we have standard measurement. Non standard measurements change depending on what we use to measure. They need to be aware that all tools of measurement have two parts: a number and a unit. Whether we are measuring with standard units used in the United States, or metric units, all tools still have the two parts.

Students should be able to use their basic math knowledge to add three digit numbers together to determine the total distances measured.

Research Basis

Reynolds, A., Wheatley, G. H., (1997). Third Grade Students Engage in a Playground Measuring Activity. *Teaching Children Mathematics*. V4 n3 p166-70.

The authors discuss the benefits of expanding students hands on learning outside the classroom. Classroom settings(microspace) should be where the main teaching and practice take place but students need to transfer their knowledge and expand on it in a larger setting(macrospace). By doing this the authors found that students' unitizing activity in a variety of settings was associated with advances in mathematical thinking.

Akerson,V. L., Kelso, R,. (2004). Math Conncections: Science and Engineering Applications in an Elementary Classroom. http://www.ed.psu.edu/CI/Journals/2000AETS/04kelso_akerson

The authors express how important it is for students to relate what they have learned in the classroom to life beyond the classroom

walls. When learning is extended across subject lines and into the real world, students' acquisition of knowledge is greatly enhanced.

Invitation to Learn

If you were an inchworm what would you be able to measure? Give each student a 1 inch rubber worm and invite them to find things in the room that are one inch, two inches, three inches or four. In their math journals have them make a tally chart showing how many items they found for each. Read *Inchworm And A Half* by Elinor J. Pinczes. Discuss how the inchworm had to get the help from his friends, focusing on the half inch and fourth inch, to complete the task of measuring everything in the garden.

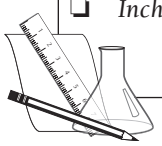
Instructional Procedures

What's in an Inch?

1. Pass out a ruler and magnifying glass. Using the overhead ruler, show the students where an inch is located and have them find it on their own ruler.
2. Explain that an inch is divided into many different parts. We are going to look at two of them. Flip over the next layer on the overhead ruler and place the whole and half fraction bars to demonstrate. Point out that when we find the middle of the inch, it is called a half inch.
3. Flipping over the next layer on the ruler and displaying the two parts of the fraction bars that make up a fourth, explain that each half is then divided in half and we call that one fourth of an inch and when it comes after the half inch it is call three fourths of an inch.
4. Check to see that all students have successfully located the one-fourth inch between 0-1/2" and three fourths of an inch between ½-1".
5. Pass out a 10-inch piece of yarn, an index card and scissors to each student. Tell them that we are going to be measuring our smile.
6. First they will measure their own smile to the closest ¼" with their yarn and cut it. On their index card they will write "Name's Smile". Under their name they will write how big their smile is in inches. Make sure they leave enough room on the card to attach their individual string later.

Materials

- ❑ Standard Ruler
- ❑ Magnifying glass
- ❑ Measurement worms
- ❑ Index card
- ❑ Yarn
- ❑ Scissors
- ❑ Glue
- ❑ Yardstick
- ❑ Overhead ruler
- ❑ Overhead fraction bars
- ❑ Post-it note
- ❑ *Measurement Cards*
- ❑ *Inchworm And A Half*



7. Next, students will use the other side of their ruler and measure their yarn to see how many centimeters it is. Record it on the card under the measurement for inches.
8. Group the students in four or five and instruct them to combine their strings, end to end, and measure how long their group smile is. One student per group will write their total on the post-it note.
9. Students will now glue their individual strings to their index card with glue.
10. Make a frequency table on the white board and have one student from each group record their total on the table.
11. After adding all the totals together, write the grand total on the board telling the students that we will now make a class smile. Discuss ways that we could measure this large number instead of inch by inch.
12. Measure the length in yarn of the class smile using a ruler or a yardstick. On a poster board write "Our Class is all SMILES" and record the total smile in yards, feet and inches. Display the class string along with student's individual smile cards in the hallway.
13. Students create a pocket in their math journal to save their smile card in, once the display is removed.

What's Beyond and Inch?

1. Remind students that we used other tools to measure our class smile instead of measuring inch by inch. List the tools on the board and explain that we are now going to expand our knowledge of measuring to measuring the width of our classroom.
2. Group students in four or five. Explain that using inches would be too difficult and that we can measure by feet or by yards. Ask them, when you say "feet" what does it make them think of?(their own feet)
3. Assign each group to an area in the room to work. Have them take turns putting one foot in front of the other until they get to the other side of the room. Give each group a scratch paper. Have one student write everyone's name in the group on the scratch paper along with their estimate of the classroom width.
4. Record all estimates on the whiteboard. Discuss the difference between the totals and why they are so different. Explain

Materials

- ❏ Standard Ruler
- ❏ Foot Ruler
- ❏ Yard stick
- ❏ Pencil
- ❏ Paper Airplane
- ❏ Scratch paper
- ❏ Painter's Tape
- ❏ Pencil
- ❏ *Eventful Activity Cards*

that this is a nonstandard unit of measurement and that not all students have the same size foot.

5. Pass out 2 foot rulers to each group. Have them place the foot on the floor next to their own foot. Which is bigger? (the foot ruler) "Imagine how long your foot would be if it was an official foot long."
6. Go over the attributes of the foot. Show the students how a foot is similar to an inch where it has a one-fourth measurement, a half measurement, and a three-quarters measurement.
7. Using their foot rulers, placing them end to end, students will again measure the width of the classroom. Discuss how many actual feet wide the classroom is.
8. Record how many feet wide the classroom is on the whiteboard and compare it to the estimates.
9. Discuss how this activity could have been easier if a yardstick had been used. How many yards wide is the classroom?
10. Once students have complete their classroom measurements, take them to an area where a long jump, ball toss, and airplane launch can take place.(gym, commons area, outside) Students will need their math journal and a pencil.
11. Assign students to three groups. The three stations have a starting line, instruction card, and measurement tools.
12. As students complete their designated task, he/she will record results in math journals under a title Eventful Activities. Record the station visited and the distance measured for each activity.
13. At the signal of the teacher, students rotate to the next area until all tasks have been completed.

Assessment Suggestions

- As students turn in their index cards to be displayed, check to see that they have labeled and recorded their information correctly.
- Journal Entry-Students will glue measurement cards (one inch, one-half inch, and one-fourth inch) in their journals. Under each card have students write a definition for each and cut a piece of yarn to match each measurement.
- Journal Entry- Have students create a reference chart. How many inches in a foot. How many feet in a yard.

Curriculum Extensions/Adaptations/ Integration

- For measuring small objects, have students write their full name on graph paper and measure its length. Students then compare the length of their name to other students in the class.
- As an extension, challenge students to convert their measurements to another form, such as inches to feet.
- Explain that we can also use our body to measure objects. Our index finger from first knuckle to second knuckle is one inch, etc.
- If Force and Motion lesson has been taught, use airplanes that were made for the airplane launch in the Eventful Activities.

Family Connections

- Challenge students to do the same smile measurement activity with their family and bring the results the following day to compare with the rest of the class.

Additional Resources

Books

Inchworm And A Half, by Elinor J. Pinczes; ISBN 039582849X

How Big Is A Foot?, by Rolf Myller; ISBN 044040495

How Big Is It?, by Ben Hillman; ISBN 0439918936

Twelve Snails to One Lizard, by Susan Hightower; ISBN 0689804520

Millions To Measure, by David M. Schwartz; ISBN 043963389

Hershey's Milk Chocolate Weights and Measures, by Jerry Pallotta; ISBN 0439388775

Snakes Long Longer Longest, by Jerry Pallotta and Van Wallach; ISBN 0439896258

How Long or How Wide?, by Brian P. Cleary; ISBN 9780822566946

Web sites

http://www.brainpopjr.com/math

http://classroom.jc-schools.net/math-unit/anprob.html

http://www.edhelper.com

Measurement Cards

One Inch
Half Inch
One Fourth Inch
Three Fourths Inch

Eventful Activity Cards

Long Jump

Materials: ruler or yard stick

1. Stand on starting line.
2. Jump forward
3. Have a partner measure the length of your jump.
4. Write the length in your journal.

Snow Ball Toss

Materials: scratch paper, ruler, or yard stick

1. On a piece of scratch paper, write something new you learned about measurement. Crumple paper into a ball.
2. Standing on starting line, toss the paper ball.
3. Measure the distance the ball traveled.
4. Write the distance in your journal.

Leave balls in position thrown until group member have had a turn. When teacher signals to change stations run and grab a paper ball and read what someone else has learned about measurement.

Airplane Launch

Materials: paper airplane, ruler or yard stick.

1. Stand on starting line.
2. Launch airplane.
3. Measure the distance the airplane flew.
4. Write your distance in your journal.

WOW! How Time Flies!

Math Standard IV

Objective 2

Connections

Standard IV:

Students will select and use appropriate units and measurement tools to solve problems.

Objective 2:

Solving problems involving measurements..

Intended Learning Outcomes:

5. Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.
6. Represent mathematical ideas in a variety of ways.

Content Connections:

Language Arts 1-1; Develop language through listening and speaking.
Language Arts VIII-6; Write in different forms and genres.

Background Information

Students need to have a basic understanding of how a clock works and be able to display time to the hour and half hour. They should also be able to represent a time on an analog clock and duplicate the same time in digital form. Students should know that 12:00 a.m. is midnight and 12:00p.m is midday and the times between them are a.m. and p.m.

Students should be familiar with story problems and be able to understand what the problem is asking by locating the facts and determining what operation is needed. They should be able to represent their thinking by expressing their answers on paper.

Research Basis

Heddens, J. W., Improving Mathematics Teaching by Using Manipulatives. Retrieved December 5, 2007, from http://www.fed.cuhk.edu.hk/~fllee/mathfor/edumath/9706/13hedden.html

What are manipulative materials? Manipulative materials are concrete models that involve math and can be touched and moved around by the students. They must be materials that relate to the students' real world. They should be selected for the appropriate concept being developed and on the appropriate level for the students.

Battle, T. S., (2007) Infusing Math Manipulatives: The Key to an Increase in Academic Achievement in the Mathematics Classroom. (ERIC identifier: ED498579). Retrieved January 8,2008, from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/33/c0/97.pdf

Due to the lack of interest and understanding of concepts, students struggle in mathematics. Research shows that students' achievement increases when manipulatives are incorporated in a lesson. When

students are actively learning using manipulative materials they are able to apply what they learn to their own lives, thus forming a link between concrete and abstract learning.

Invitation to Learn

Using math journals have students cut a vertical and horizontal line in the middle of their paper. They will put a thin line of glue down the right hand side, gluing it to the page underneath. Fold back each corner in the center of the page to create a small triangle. Underneath the triangle place a clock that displays all numbers. Place clock so that the six and twelve are lined up under the vertical line and the three and nine line up under the horizontal line. Use a brad to fasten the hands on the clock. Explain to students that a clock is divided up into four parts just like and inch. Have them color each quarter of the clock a different color. Label the top right fold: quarter after = 15 minutes, lower right fold: two quarters = 30 minutes, lower left fold: three quarters = 45 minutes, and top left fold: four quarters = 1 hour.

Materials

- ❑ Math Journal
- ❑ Scissors
- ❑ Glue
- ❑ Crayons
- ❑ Judy Clocks
- ❑ Overhead projector
- ❑ Brad
- ❑ *Analog Clock*
- ❑ *Elapsed Time Ruler*
- ❑ *Time Problem Cards*
- ❑ *Time Problems- Work It Out*
- ❑ Baseball Time Game
- ❑ *Baseball Handout*

Instructional Procedures

Using a large Judy clock, demonstrate how the minute hand moves around the clock and as it makes a complete circle the hour hand moves gradually to the next whole number. Explain to students that we are going to be learning how much time passes from a starting time to an ending time. We call this elapsed time.

1. Pass out elapsed time rulers. Have students color the left side from 12:00 a.m. to 12:00 p.m. red and the right side from 12:00 p.m. to 12:00 a.m. blue. Explain how the red side is a.m. and the blue side indicates p.m. Have students cut out their ruler and glue it together with the numbers facing out and the 12:00 a.m. marks overlapping. Explain how we can count in the circle to figure elapsed time.
2. On the overhead, use a marker to draw a t-chart. Demonstrate how we can use a t-chart to figure elapsed time. Jamie put dinner in the oven at 5:15. It cooked for 2 hours. What time was the dinner ready to eat? At the top on the left side write the start time- 5:15. On the top at the other side write hour. In between the two draw an arrow pointing up to show that we are counting up. Next, make several horizontal lines going down the t-chart. Under hour write 1, 2. On the other side, under 5:15, count up the time by hours until it is on the same line as

the 2. The left side should say 6:15, 7:15. The answer is 7:15. Have the students circle it.

Demonstrate figuring that an activity starts at 4:30 and ends at 7:30 we can use our t-chart to see how long the activity lasts. Draw a t-chart. At the top left side write the start time-4:30. On the top right side write hour. In between the two draw an arrow pointing up to show that we are counting up. Make several horizontal lines going down the t-chart. Under the start time count up by hours, writing them on the line, 5:30, 6:30, 7:30, until you get to the ending time. On the side with hours count up by ones to the line that matches on the left side with the ending time (1,2,3). Circle the 3. This is how much time has passed.

3. Using the 28 time problem cards, read a problem and have the students solve it by using their elapsed time ruler and a t-chart. Students may use the time problems- work it out worksheet to help determine what the question is asking.
4. Once students understand the concept of elapsed time, play "Baseball Time". Baseball Time is created using green poster board. Use the board so that it is diamond shaped. Place home plate at the bottom and the three other plates in a diamond shape to home plate. You will need a baseball clipart for each student. Divide the class into two teams (A and B). Team A is "up" first. One at a time, give each student a time story problem. If the problem is answered correctly, the player scores a hit and all the players on base advance one base. If the answer is incorrect, the player scores an out. After one team has scored three outs, the next team is up. All students have a Judy clock and are figuring the problem at the same time as the student that is up to bat.

   The team with the most points wins.

Assessment Suggestions

- As students are playing "Baseball Time" teacher will assess knowledge of concept by verbal responses to problems.
- Journal Entry- Have students draw two clocks in their journal. On the first clock, have them draw the hands to tell what time, to the closest quarter hour, they start school. On the second clock, they will draw hands to tell what time (to the closest quarter hour) they get out of school. Using a t-chart to determine how many hours they are in school.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners could figure time to the minute. On the right side of the t-chart they would write minute and count either by 1, 5 or 10 to get to the correct time on the left side.
- When students feel confident with figuring elapsed time, have them play "I have…Who has?"

Family Connections

- Encourage students to create problems at home and then figure elapsed time. Example; Dad leaves for work at 7:30 a.m. and returns home at 5:30 p.m. How many hours did Dad work?

Additional Resources

Books

How Do You Know What Time It Is, by Robert E. Wells; ISBN 0807579394

Math Curse, by Jon Scieszka and Lane Smith; ISBN 0670861944

Games

Race Around the Clock

I Have… Who Has… Mental Math Practice Cards- Elapsed Time

Web sites

http://www.harcourtschool.com/activity/elab2002/grade_3/018.html

http://www.edu4kids.com/index.php?TB=20&page=13

http://www.shodor.org/interactivate/activities/ElapsedTime/?version=1.5.0_06&browser=MSIE&vendor=Sun_Microsystems_Inc.

Time Problem Cards

Brenda ran track. She had a track meet today that would start at 11:00 a.m. and finish at 4:00 p.m. How long will her track meet last?	Colton and his friends loved to play video games. They all met at Robert's house and played for 2 hours and then went to the game store for 1 hour. Colton got home at 8:00 p.m. What time did he meet his friends at Roberts?
Kathy was going to be in the school play. It is 2:30 p.m. and rehearsals will begin in 3 hours, but Kathy still needs to learn her last part. How much time does Kathy have to learn her part?	Max and his family went to the zoo. They arrived at the zoo at 10:15 a.m. After visiting all the animals for 3 hours, his family had a picnic at the zoo park. They left the zoo at 2:15p.m. How long was their picnic?
Brianna loved to draw and had entered her pictures in an art contest. It is 8:00 p.m. and she must have her pictures to the show by 7:00 a.m. on the next day. How much time does Brianna have to get ready for the art show?	Steve is late for school. School starts at 8:45 a.m. and Steve arrived at 10:45 a.m. How late was Steve for school?
Amy's mom was having lunch with her friends today. It was 10:45 a.m. and Amy's mom asked her to help get things prepared for their lunch at 12:45p.m. How much time do they have to prepare for lunch?	Kent's family went to Disneyland. They left their house at 7:30 a.m. to catch their flight. They arrived in California at 11:30 a.m. and got to their motel at 12:30 p.m. How long did Kent and his family travel for?
Olivia and her best friend are going to a concert. The concert will start at 7:00 p.m. and will be over at 12:00 a.m. How long will the concert last?	Today is Jackson's big day. He is graduating from high school. He is so excited that he wakes up at 5:30 a.m. Graduation starts at 6:30 p.m. How much longer does Jackson have to wait?
Rose is starting her new job. She needs to be at work by 7:00 a.m. and will finish at 4:00 p.m. How long will Rose be at work?	Logan and Lincoln are Ute Football fans. It is 9:30 a.m. and Logan's dad is taking them to their first game. The game will start at 12:30 p.m. How much time do they have to get to the game on time?
The Jensen's family reunion is today. They left their house at 11:15 a.m. and have to travel for 4 hours. What time will they arrive at the reunion?	It was 3:00 p.m. and the Andersons needed to be to the movie in 1 hour. What time does the movie start?

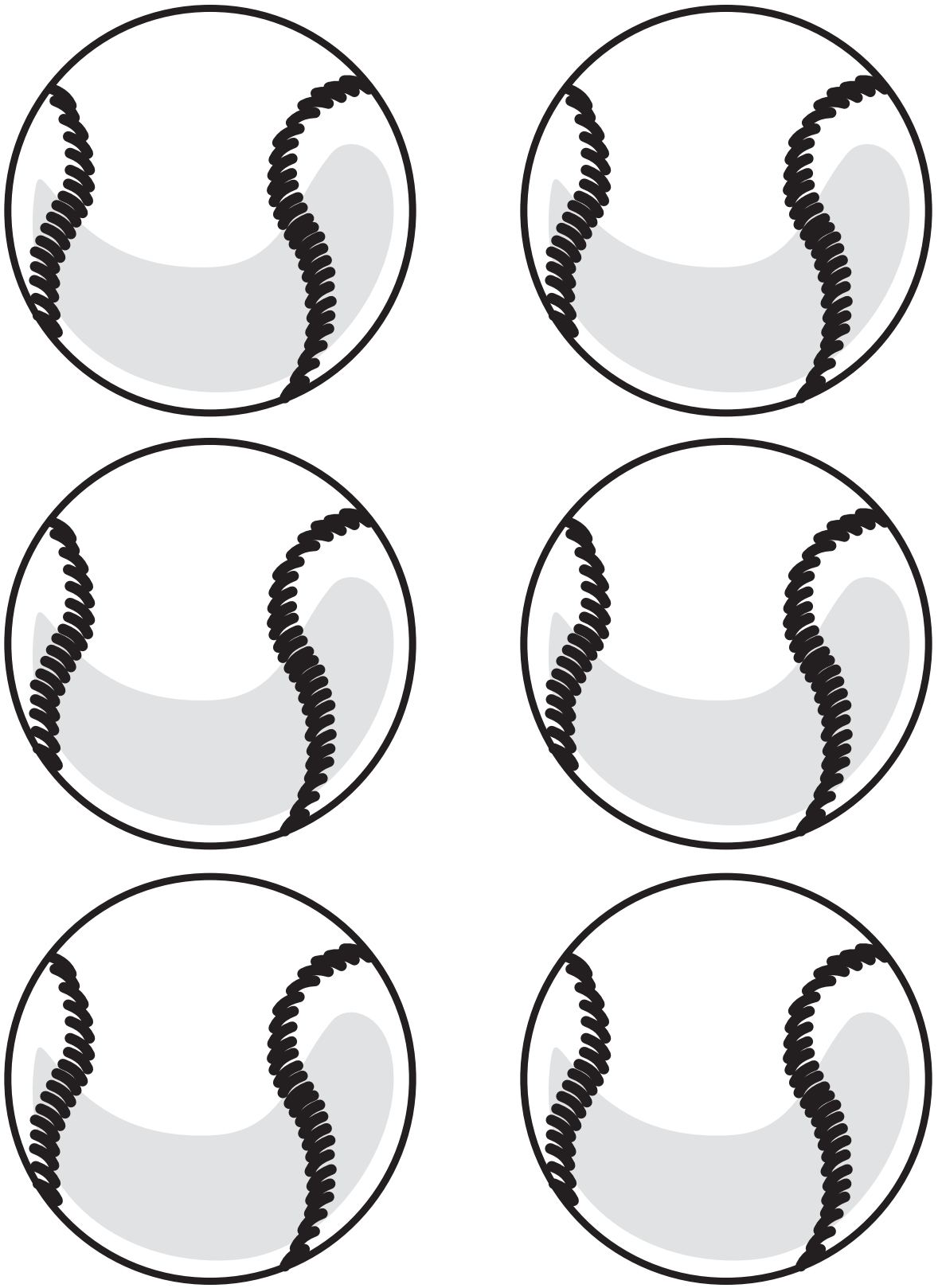
Time Problem Cards

Jenna has piano lessons at 4:30 p.m. It is now 11:30 a.m. How long does Jenna have until her lessons?	Jim started work at 6:00 a.m. He took one hour for lunch and finished work at 3:00 p.m. How long did Jim work for?
Cyndi got a new puppy for her birthday. She took the puppy to show her friends. She left at 4:45 p.m. and returned home at 5:45 p.m. How long was Cyndi gone for?	Kevin's game starts at 6:30 p.m. He still has to do his homework before the game. It is now 3:30 p.m. How much time does Kevin have to finish his homework?
Sally went for a ride on her scooter. When she got home it was 7:00 p.m. She rode her scooter for two hours. What time did she leave her house?	Mark's cat was lost. Jason told Mark that he saw a cat an hour ago. It was now 12:15 p.m. What time did Jason see the cat?
The Smith family went for a hike. When they got in the car to leave it was 9:00 a.m. When they returned home it was 2:00 p.m. How long was their hike?	Juan was excited to see the new movie that his mom told him about. The movie was going to start in 7 hours at 6:00 p.m. What time is it now?
It is 8:15 a.m. and Shelly's Grandma King is going to visit them today. Grandma told Shelly that she would be there at 1:15 p.m. How much longer does Shelly have to wait to see her grandma?	Kenny and Tommy were waiting for the swimming pool to open. The pool hours are from 11:00 a.m. to 10:00 p.m. How long could Kenny and Tommy stay at the pool?
Gabby was so excited for her first day of school in third grade. She goes to bed at 8:30 p.m. and wakes up the next morning at 6:30 a.m. How long did Gabby sleep for?	Sonja's parents both work. His mom gets home from work at 4:00 p.m. and his dad gets home at 6:00 p.m. How much later does Sonja's dad work than his mom?
Carrie went to play at Patty's house at 2:00 p.m. They played for 2 hours and then went to Carrie's house and played for 1 more hour. What time did Patty leave to go home?	David fell off his bike and cut his knee. His mom took him to get stitches. When he got home, it was 2:30 p.m. They had been gone for 3 hours. What time did David and his mom leave their house to go and get stitches?

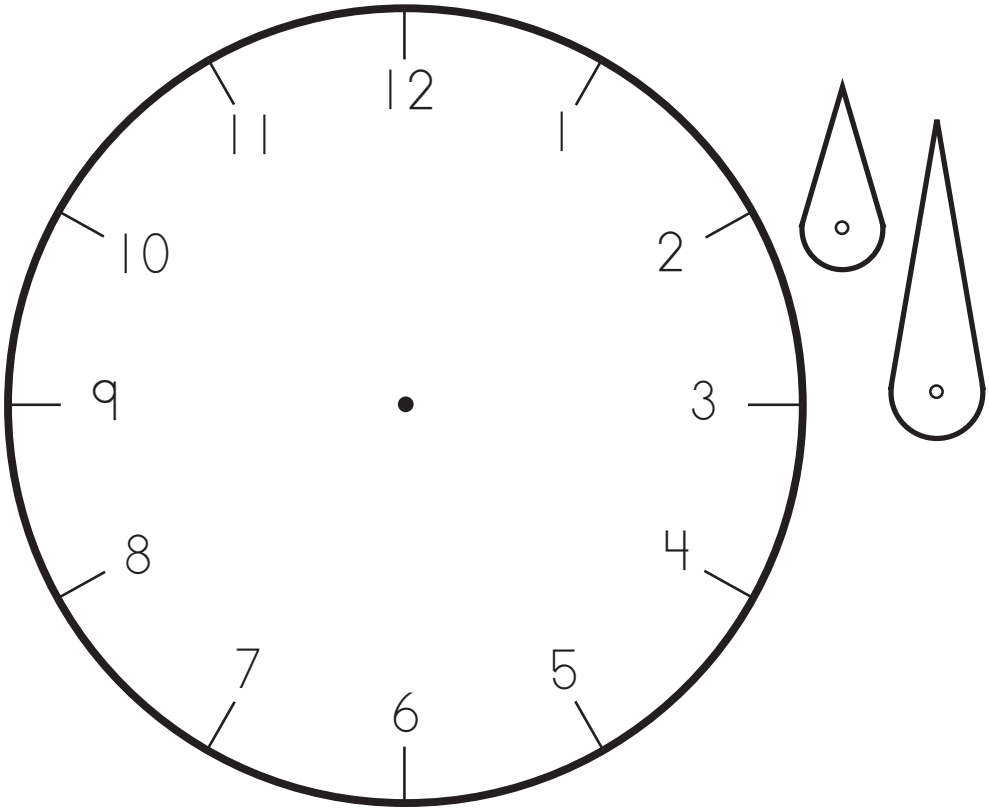
Time Problems–Work It Out!

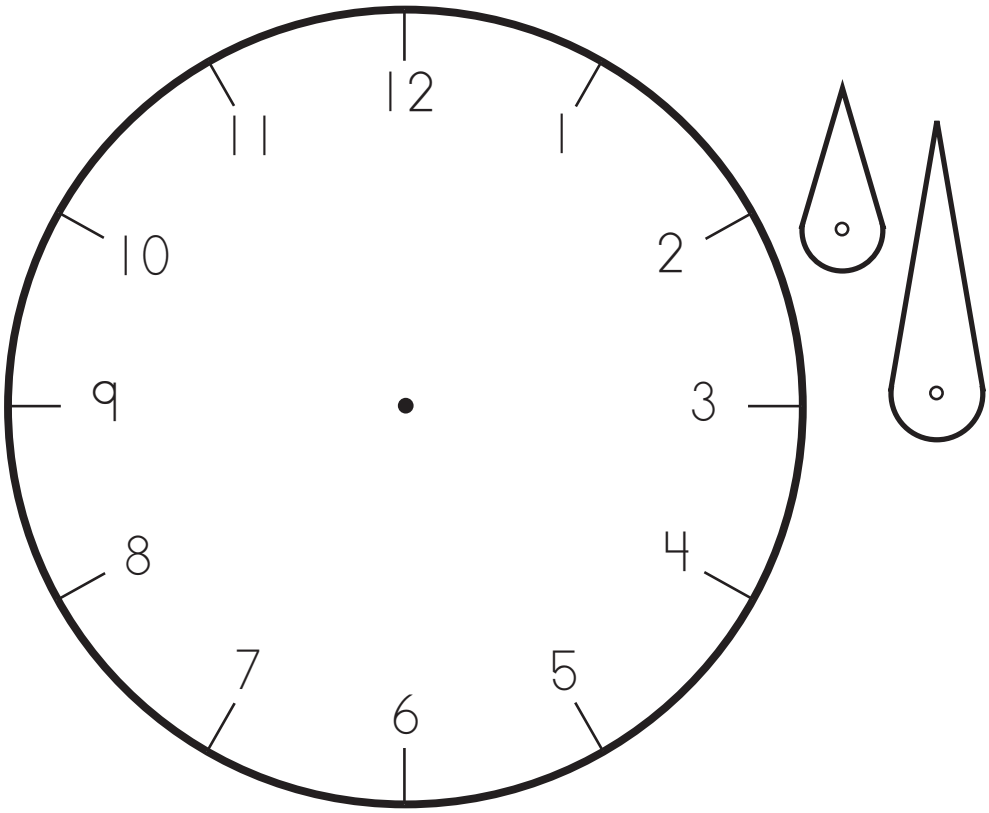
Place Time problem here	
Explain to me what they are asking.	What are the facts? Are there any important words?
What is your plan? Show me.	Why do you feel your solution is correct?

Baseball Handout

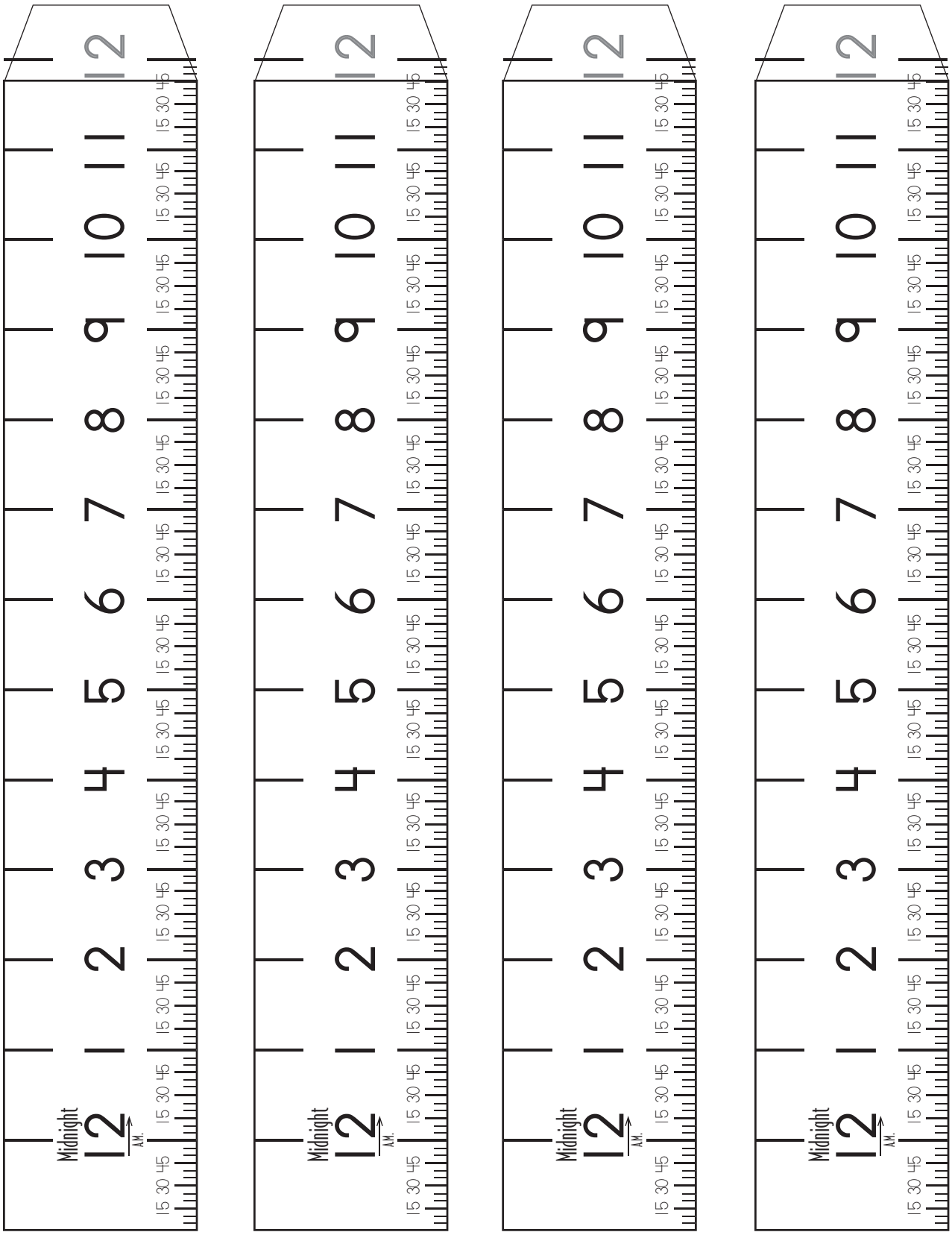


Wow! How Time Flies

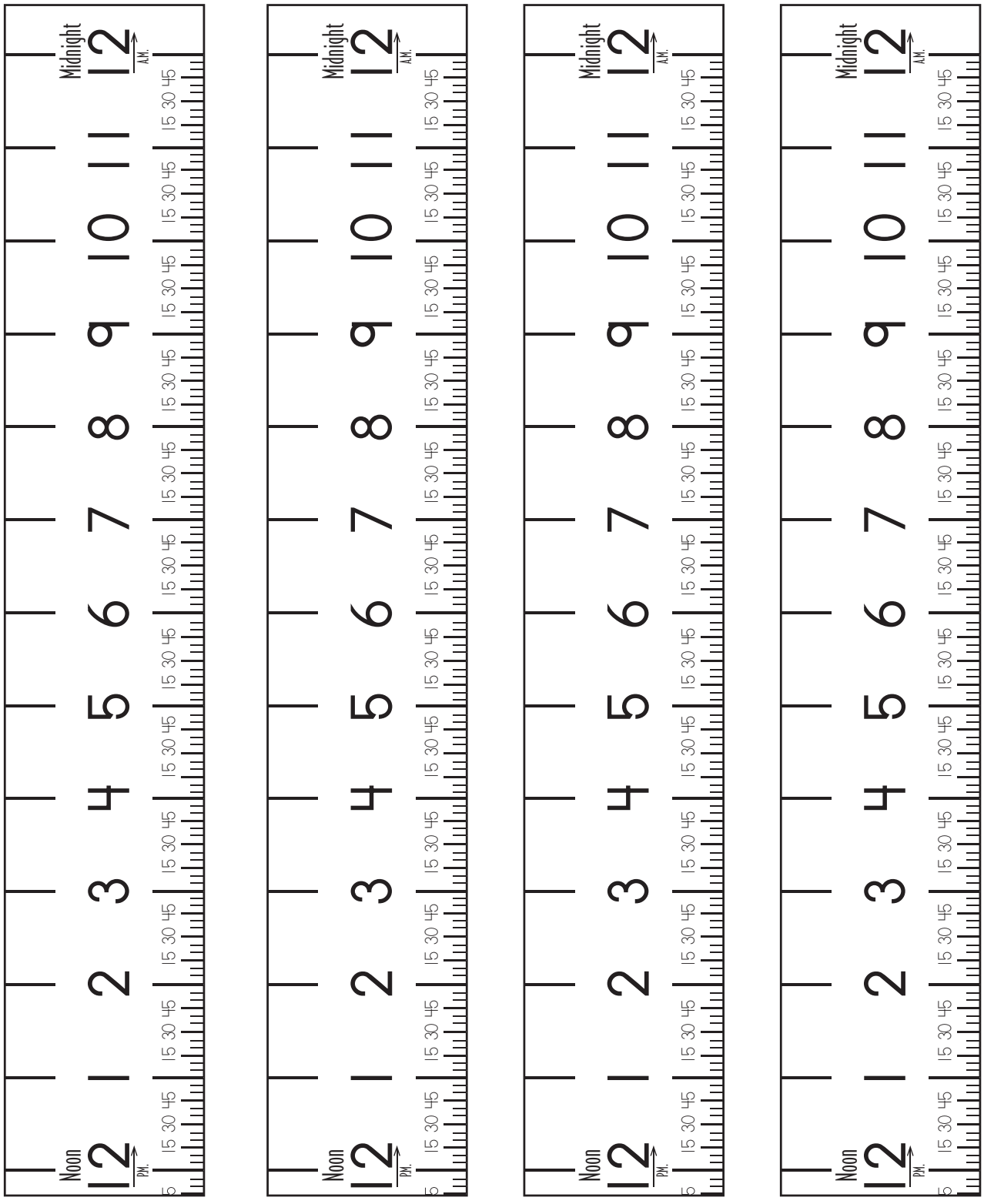




Elapsed Time Ruler



Elapsed Time Ruler



Science I

Activities

Moon

The Earth Is Flat

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 the moon moving through the sky.

Objective 1:

Describe the appearance of Earth and the moon.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Math III-1; right angle, Math IV-1; elapsed time
Social Studies III-1; development of culture

Science Standard I

Objective 1

Connections

Background Information

The fact that Earth is not flat is not obvious to children. It is a sphere that is 7,926.41 miles (12,756.32 kilometers) in diameter at the equator. One of the first ways that we suspected that Earth was round was because we could see its shadow on the moon during an eclipse.

It would be helpful for the teacher to practice with the pencil top to find the best length for the pencil. Longer pencils do not work as well. In my observations it seemed best to have a pencil about 2 inches long.

Research Basis

Furner, J. M., Yahya, N., and Duffy, M. L., (2005). 20 Ways to teach mathematics: Strategies to reach all students. *Intervention in school and clinic,*. Volume41, No. 1 (September 2005), Pages 15 -23.

Even though this article is written with different approaches to teaching mathematics, the hands-on activities, heterogeneous grouping, charts, auditory, visual and kinesthetic approaches work well in nearly any setting or grouping. It is just good teaching.

Invitation to Learn

The Flat Spinning Earth

Hand each student a washer and ask them to identify ways that the washer and Earth are the same. Color and cut out the outline drawings of Earth and glue them to one side of the washer. Using a single light source, like the sun coming through the window or a desk lamp and a playground ball or globe as a backdrop, invite them

Materials

- ❑ *Polar Projection of Earth*
- ❑ Fender washer
- ❑ Globe
- ❑ Journal

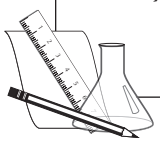
to notice the different possibilities of shapes made by the washer and record them in their journal. Now pass out a ping pong ball and ask them to identify and draw as many different shapes as can be made by the ball. Are there ways the washer makes a circular shadow? Is it possible to make the washer continuously appear to make a circular shadow? Instruct the students to make a Venn Diagram in their journal comparing Earth and the moon.

When we are outside, where and when can we see the shadow of the moon and Earth? Does this teach us about the shape of the moon and Earth? How? Take time to answer questions about eclipses.

Instructional Procedures

Materials

- ❑ Pencil
- ❑ Ping-pong ball
- ❑ Pizza box
- ❑ Aluminum foil
- ❑ Glue stick
- ❑ Crayons



The Flat Spinning Earth on an axis

1. "What do you do with a pencil that is too short to reasonably hold?" Ask the students to get the pencil that has been sharpened to within two inches of its life.
2. Insert the pencil into the hole in the washer far enough that friction will solidly hold it in place.
3. Write the word "axis" on a small piece of tape and attach it to the pencil nearer the eraser end.
4. Write the word "rotation" near the outer rim of the washer.
5. Practice spinning the "Earth top". If it wobbles try to figure out why. What makes it spin longer? Does it help if the washer forms a right angle to the pencil all the way around?
6. Discuss the axis as it relates to the map of Earth on the washer with others at your table. Does Earth really have a pencil stuck through it? Does Earth spin like the washer?
7. Spin the ping-pong ball. Is there a place it seems to spin around? How is the ping-pong ball like Earth? How is the pencil in the washer like Earth?
8. Set the ping-pong ball aside for use in a later activity.
9. Make a pocket in your journal to store your disassembled Earth axis (pencil) and rotation model (washer with the map).
10. Demonstrate pop-up doors and a stand up. Share some of the pop-ups the students have made.
11. Invite the class to create some pop-ups in their journal.

Assessment Suggestions

- Prior to the lesson, as pre-assessment, spin a globe of Earth and ask "Is there some part of the globe where the spinning part is the smallest? Why do you think that happens?" (It is closest to the center of the spin, 'rotation'). We call the center of the spin, axis. The part that goes around rotation.
- At random times during the year, after this activity, when the students are using their pencil for work, hold up a pencil and a washer and ask "When they are together the way we used them in Science what names did we give them?"
- Spin a ball during PE and then ask "What is the ball doing that is like Earth?" "Where is the axis?"

Curriculum Extensions/Adaptations/ Integration

- The rotation of Earth on its axis causes our day and night. The orbit of Earth around the Sun measures our years. Did the ancient Native American people have a way to keep track of the elapsed time of years and seasons? Show Chaco Canyon Fajada Butte Sun Dagger. Discuss that they understood about the apparent motion of sun across the sky and used it to measure lapsed time. Show an analemma and discuss how it shows lapsed time. Answer questions and ask if it could be used to show more than days and months. Could we expand it to show time of day, make it a sundial? Show and discuss the San Francisco "sundial". For your class it all begins with a small empty pizza box, some aluminum foil, paper, tape and a fine tipped marker or pen. Make a classroom solar calendar.
- A block of wood with a three eighths diameter hole three inches deep will help the challenged learner get the right angle between the axis (pencil) and the rotation (washer).
- Art: Earth on its axis model could be a colored pencil and then spun on a piece of black construction paper to add to other designs for fireworks display or to trace spiral type designs on other projects.

Family Connections

- Send a washer home with the student and a map to apply to the washer. With a note asking the parents to allow the student to review what they learned.
- Invite parents to help the student notice other places in life where there is an axis (like an axel on a wheel) and something rotates around it (the tire).

Additional Resources

Media

Sun Dagger video, by BullFrog Films(info@bullfrogfilms.com); ISBN (DVD) 1-59458-089-8

Pop-Up Books, by Interact (Highsmith, 1-800-359-0961, Highsmith.com); Item number - 95474

Web sites

http://www.traditionsofthesun.org/index.html

http://www.solsticeproject.org/science.html

http://www.tulane.edu/~danny/southwest.html chaco-7.jpg and chaco-8.jpg

http://epod.usra.edu/archive/images/analemma.jpg

Polar Projection of the Earth

A Moon With a View

Science 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 the 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 Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests

Content Connections:

Math V-1; Gather and record data
Language Arts VIII-6; Writing in different forms

Background Information

When Earth and moon rotate, they turn to the left. This is easily remembered by asking the students to place their hand over the heart as when saying the "Pledge of Allegiance," then push with that hand toward the shoulder closest to the hand, thus turning the individual toward the left.

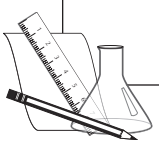
The teacher should understand that the moon and Earth do not rotate on the same plane. This is why eclipses are much less frequent than the students might think.

Using the technology of space travel we have been able to see both Earth and the moon from space. In this activity we will help the students understand better what astronauts and astronomers see by using technology and models.

Remember to turn the flash off on cameras for this activity, otherwise you loose the shadows we are looking for.

Materials

- ❑ "Moon in My Room" lamp
- ❑ Paper cup
- ❑ Blank paper
- ❑ Crayons



Research Basis

Waters, J. K., (2007-12-00). Social Studies Teachers' Perspectives of Technology Integration. *T.H.E. Journal,* Volume 34 (Number 12), Pages 41-44

Menko Johnson, an instructional technologist at San Jose State University, believes that successful synchronizing of technology in the classroom puts the teaching before the gadgetry and will benefit both the teacher and the student.

Starkman, N., (2007-06-00). Sound Solutions. *T.H.E. Journal,* Volume 34 (Number 6), Page 22

Poor classroom acoustics have more to do with poor learning than one might suspect. A good sound system can do a great deal to help both the students and the teacher.

Invitation to Learn

Using a "Moon in My Room" lamp, ask the students to name the phases of the moon as it moves through the eight phases of lights on the lamp. This is a great attention getter. The students will be excited to learn more.

After demonstrating the "Moon in My Room" lamp, pass out paper cups and a piece of paper to make a paper version of their own moon phases.

Use the paper cup to make eight circles on a piece of blank paper. Then draw each of the phases on the different circles and cut them out. Fold the circles in half vertically. Glue the left half of the first phase to the right half of the next phase and so on until you have glued all the way around. One of the great features of this little gem is that it works as well upside down as right side up. They now have their own moon review kit.

Have the students make a pocket for their moon review kit in their science journal.

Instructional Procedures

Which View of the Moon?

Materials

- ❑ Playground ball
- ❑ Camera
- ❑ Poster board
- ❑ Markers or crayons
- ❑ Moon review kit

1. Explain that we are going to build a model of Earth and the moon.
2. After dividing the class into small groups, ask each group to invent a constellation or choose a constellation they already know and draw it on a poster or large piece of paper.
3. Have the students retrieve their moon review kit from the invitation to learn activity above and keep it with them for this activity.
4. Move the desks away from the center of your room to make enough space in your classroom for a large circle of students.
5. Have half, (or one third if you have a large group), of the class stand in the middle of the room, in a circle facing outward. This is Earth. Make the circle as small as possible. Place a globe of Earth in the center of the circle on a table or tall cart, or hang it from the ceiling.

6. Put eight chairs in a circle around and facing Earth. If possible these should be about ten feet from Earth. These chairs mark the path of the moon.
7. Ask one child to represent the moon, or the teacher may take this place being taller than the standing students on Earth so the sun can shine on it during all phases.
8. Invite the rest of the class to hold the "constellation" posters around the outside of the room.
9. Turn on a desk lamp or spotlight to be the sun. Turn off other lights and darken the room as much as possible. The sun and moon should not be in the same plane. Discuss what would happen if they were. Explain that we would have eclipses more regularly if this were the case.
10. Invite one student to use a camera to document what Earthlings see.
11. When everyone is in place, ask the students to take time to predict what they think they will see.
12. Have the "moon" start at the chair closest to the sun. Remember, the moon should face Earth. You might have the "moon" record what it sees of Earth with a digital camera each time it moves to a new chair, remembering that the moon would always look only toward Earth. If the teacher is serving as "moon", a student may be asked to take the pictures.
13. The "Earthling" students should now move their circle to the left a full rotation taking time to find and compare what they see with the moon review kit what they are seeing of the moon after each rotation.
14. The "moon" should move one chair to the left of Earth in its orbit for each rotation of Earth. Repeat steps 12 and 13 a few times. It may not be necessary for Earth to rotate eight times before having the groups trade places.
15. Students who were "on Earth" should trade places with constellations and the moon.
16. After everyone has had the opportunity to see the view from both Earth and in space have the students return desks to their places and allow time to record what was seen. Encourage creativity in the kind of entry: pop-ups, drawings, written and so on.
17. Invite a few students to share and discuss with the class what they have recorded.

18. For review on another day, share the pictures taken with the camera and discuss and compare with journal entries.

Assessment Suggestions

- Ask the students to share with others at their table how the appearance of what we see from the moon, from Earth and from the stars is different and which one we might call "real". How does this help them understand what we see on Earth?
- Use the "Moon in My Room" to show different phases for review during different times of the day and the year.

Curriculum Extensions/Adaptations/ Integration

- Use a camera to take pictures from one of the constellations. What do you think an alien might see?
- Use the digital camera in video mode on Earth without stopping after each rotation of Earth to get a different feeling for the activity.
- Moon dance, invite everyone to hold the ping-pong ball from "The Earth is Flat" activity with only one source of light in the room at the side of the room, and ask them to turn around in a circle while watching the ball. Have them record what they saw in their science journal with pictures, words or pop-ups.
- Invite children with special needs to be the one to turn the sun on and off at the times designated by the teacher, or make sure they are part of one of the constellations. If they need to be active, have them be a comet passing through the solar system with a flashlight. Those who have trouble writing in a journal may use a tape recorder to record their ideas and then have a parent transcribe them (home connection).
- If you ask a Chinese person when their birthday is or a Muslim when the next Ramadan or Aid al Adha starts, what kind of calendar would they use to give you an answer? Discuss the fact that many cultures have used and continue to use a lunar calendar.
- Show the class how to make "pop-up" entries in their journal. Encourage some of the entries to be pop-ups. Allow for creativity and time to finish and share with the class using the document camera.

Family Connections

- Use a protractor with a straw attached along the flat side of the protractor, and a string tied through the center of the straw side with a weight at the end of the string as a measurement tool, sight along the straw and mark where the string is on the protractor. Keep a journal of the moon for one month or more. Each night at the same time of night, from the new moon to full moon, observe the moon using the protractor to note the angle in the sky for the location of the moon and which way the observer is facing, (a magnetic compass may be needed). On at least two nights go out two or three times to note that on any given night the moon seems to stay with the constellations, but on different nights it follows different constellations. After the full moon, observations will be more successful in the early morning. What path do you think the moon will follow? Does the moon track across the sky from east to west along the same path the sun does? What is the overall pattern of the moon's path across the sky in one month, 2 months, 6 months? Are those paths the same?

Additional Resources

Books

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

Space: A Nonfiction Companion to Midnight on the Moon, by Mary Pope Osborne; ISBN 0-375-81356-x

Web sites

http://www.adlerplanetarium.org/cyberspace/moon/culture.html#inca

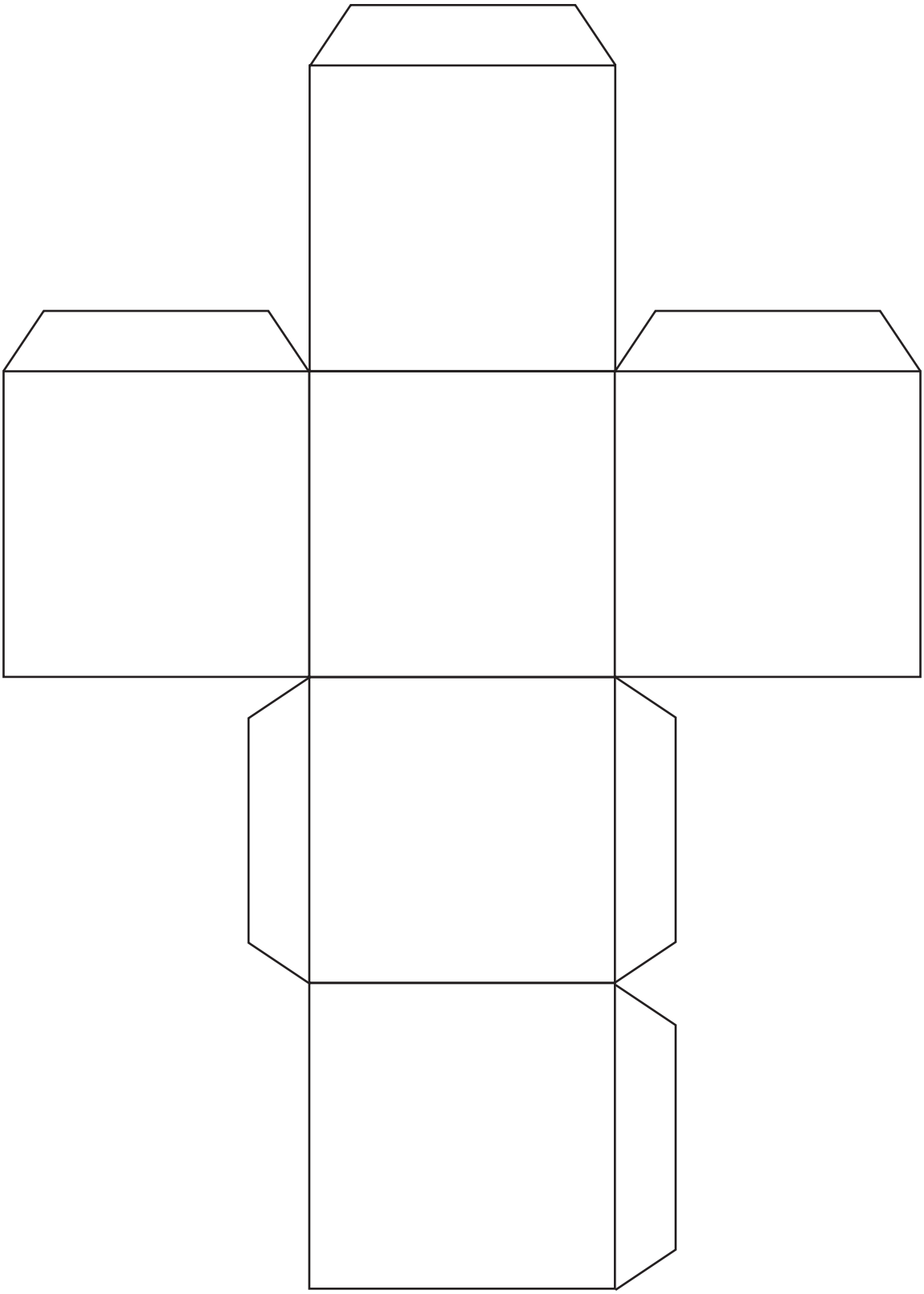
http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html

http://www.clarkplanetarium.org/astronomy_clubs.php

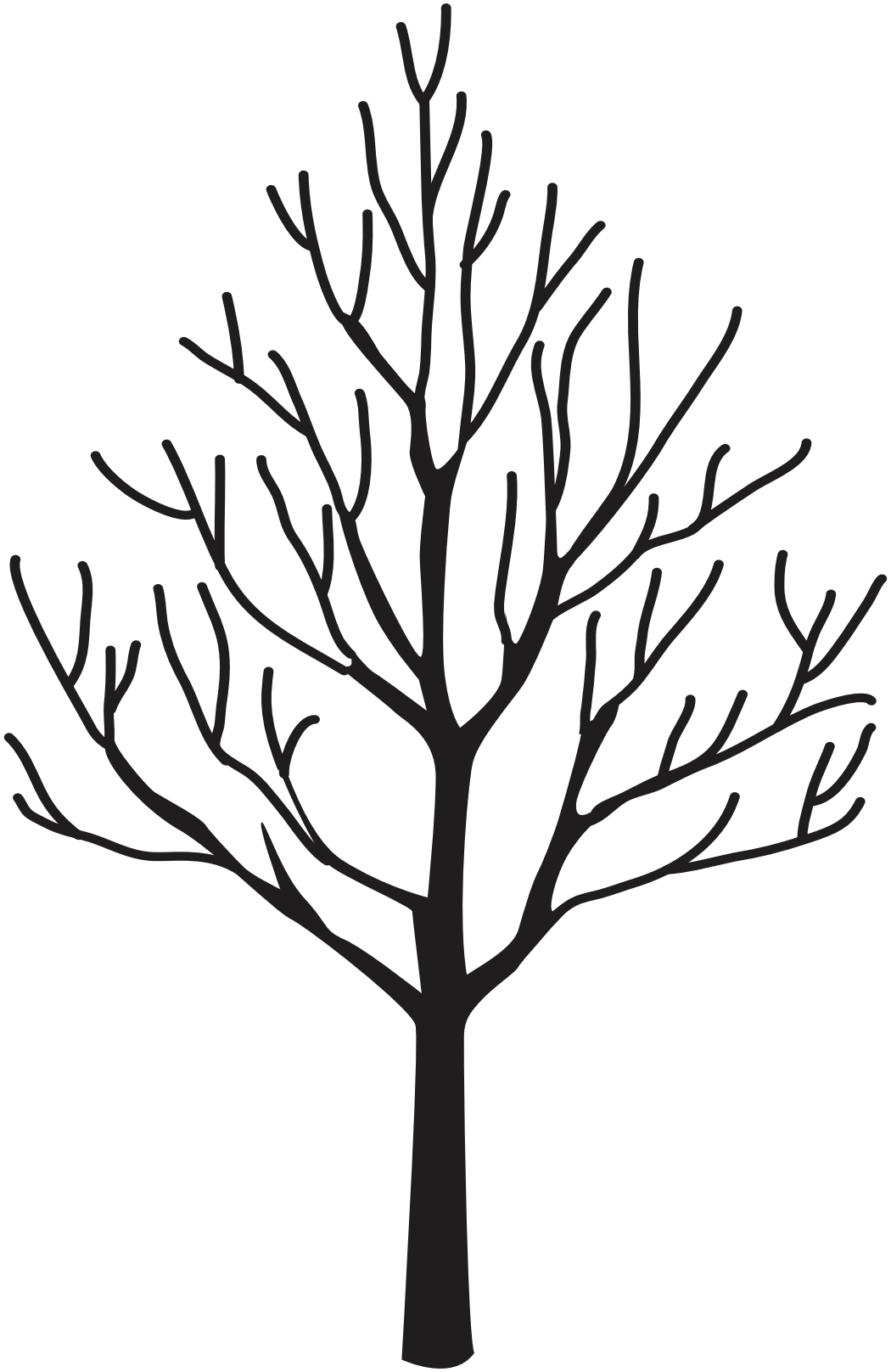
http://www.space.com/php/multimedia/imagegallery

Appendix

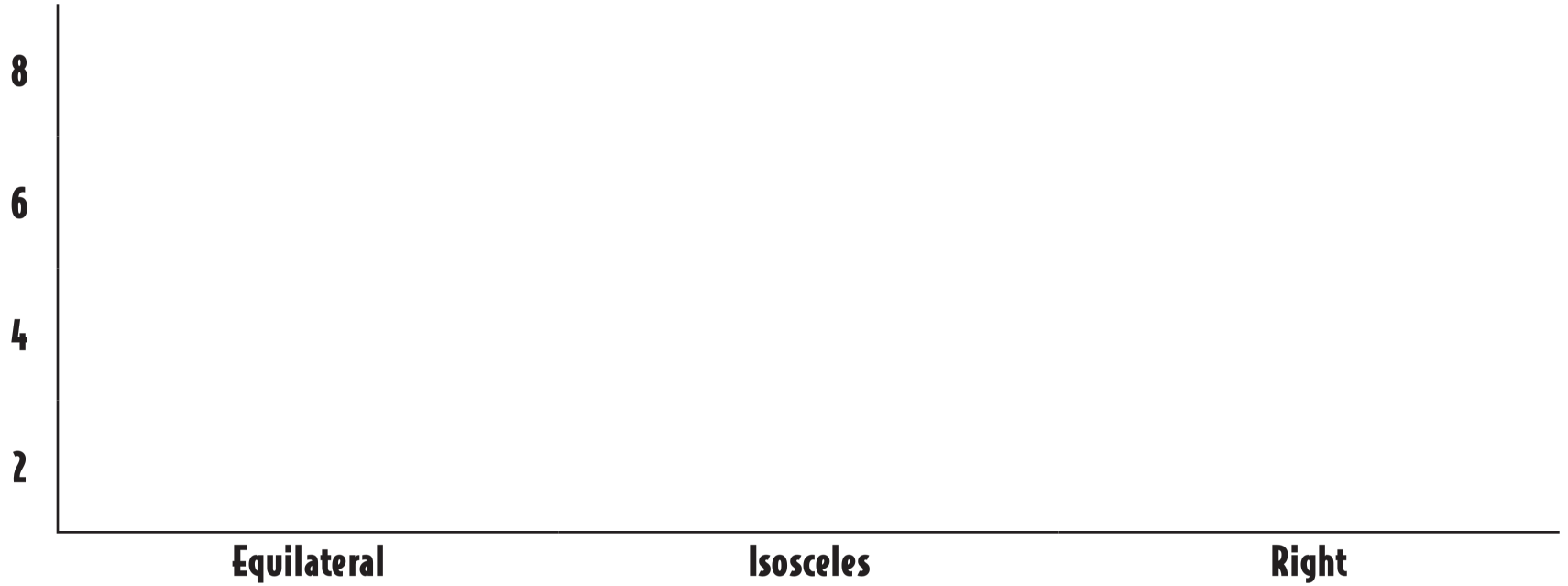
Cube



Growing Tree



Which Triangle Is It?



Red	Number of Sides
Blue	Number of Equal Sides
Green	Number of Right Angles
Yellow	Number of Greater Than Right Angles
Purple	Number of Less Than Right Angles

Dribble, Shoot, and Score

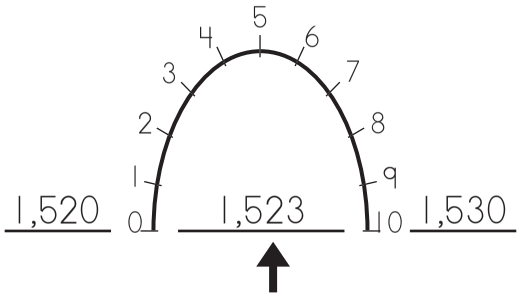


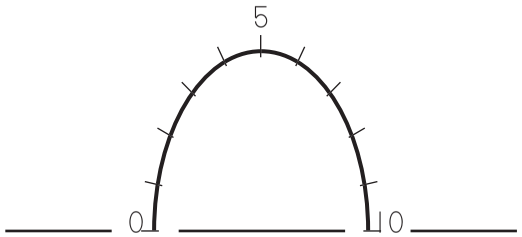


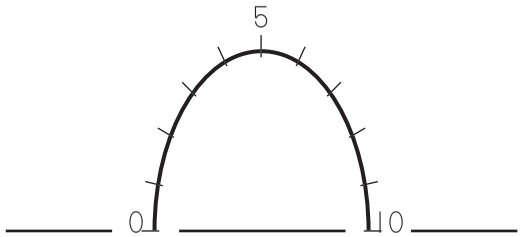

Name _____ Date _____

Rounding Mountains

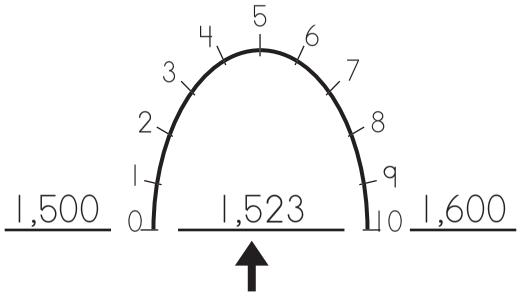
Round to the nearest 10

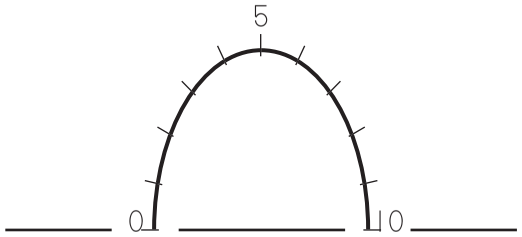


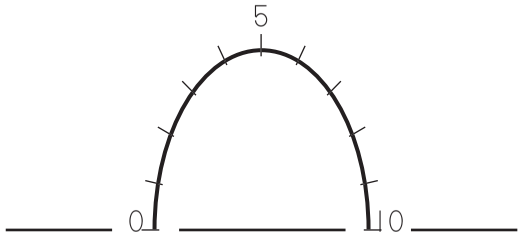




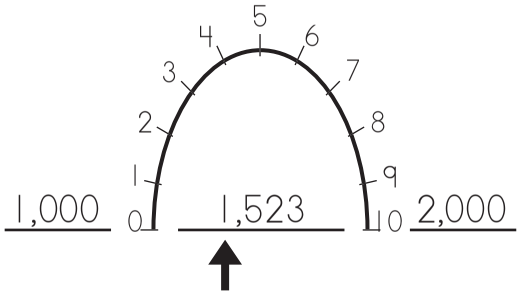
Round to the nearest 100

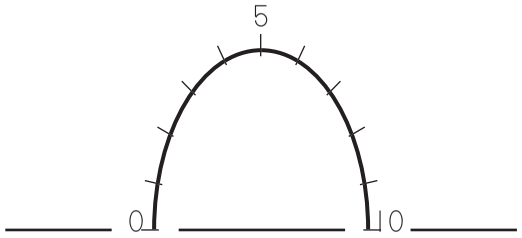


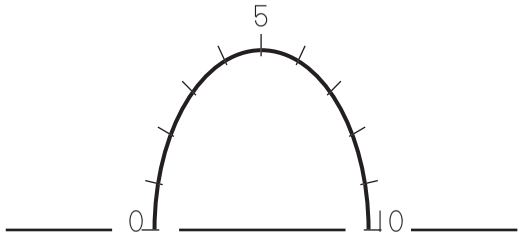




Round to the nearest 1000



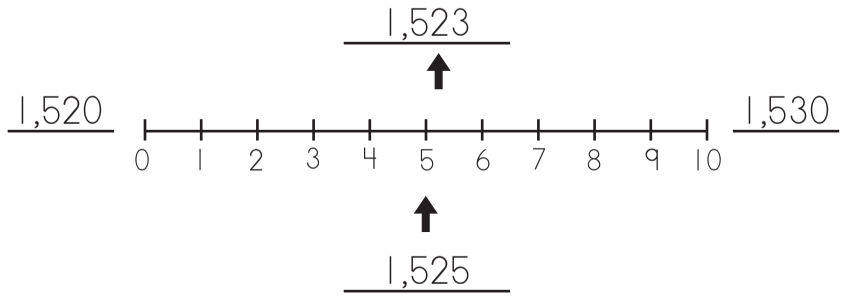


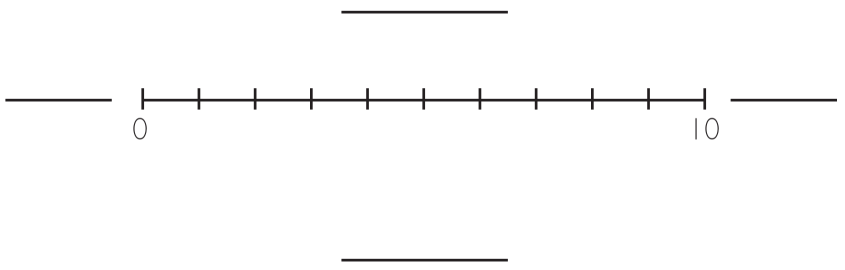


Name _____ Date _____

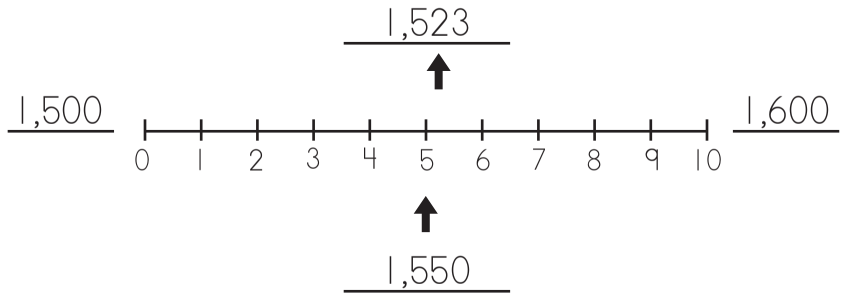
Number Lines

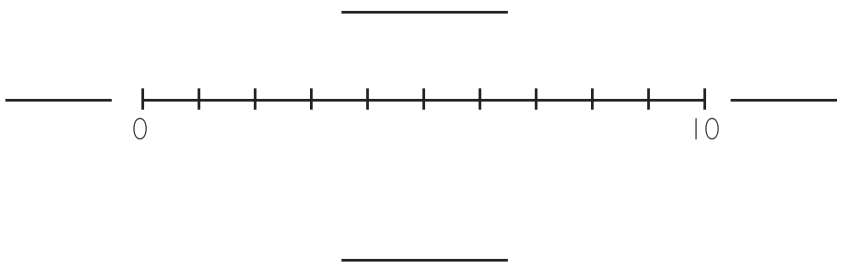
Round to the nearest 10



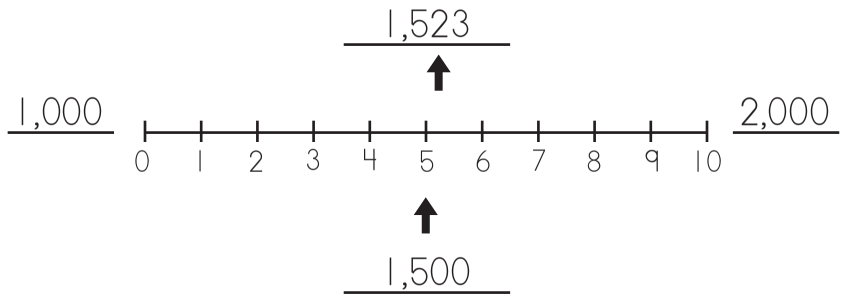


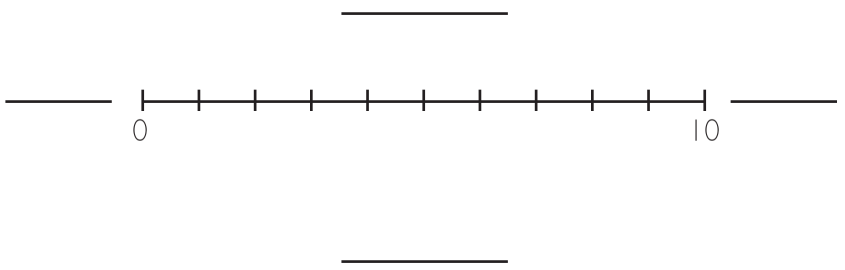
Round to the nearest 100





Round to the nearest 1000





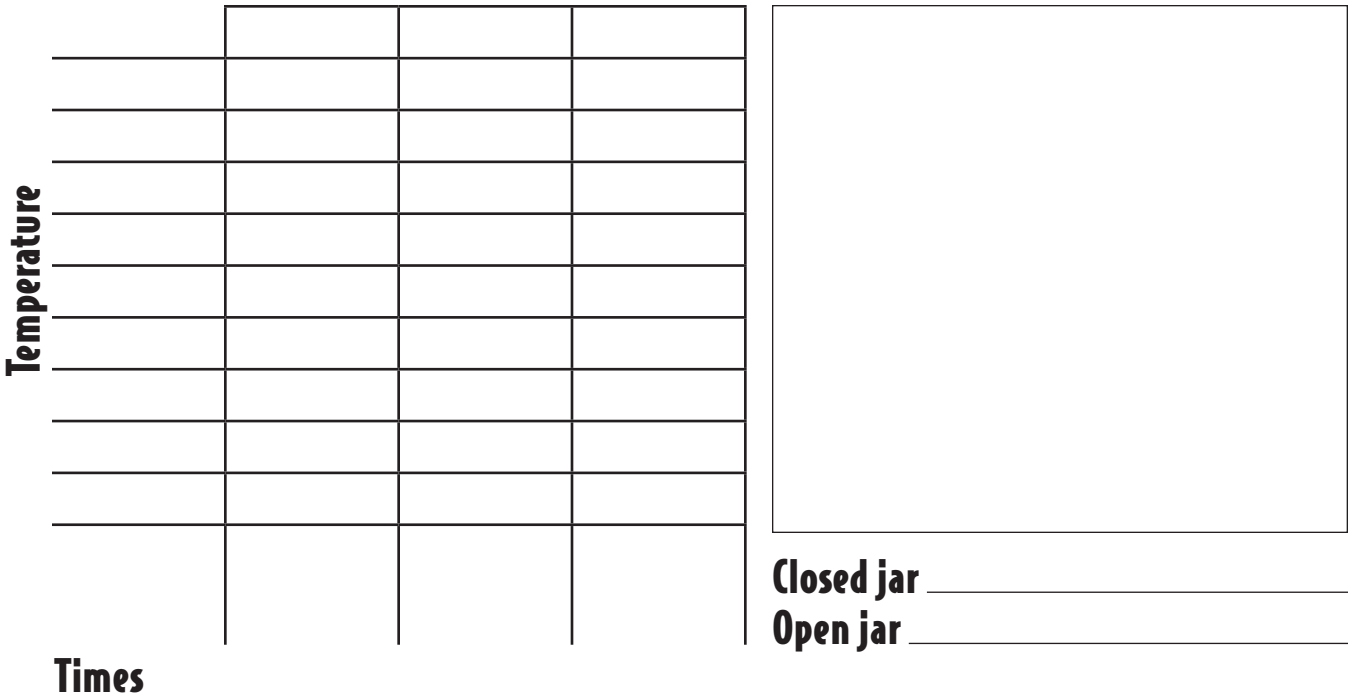
Name _____ Date _____

Race Some Beads

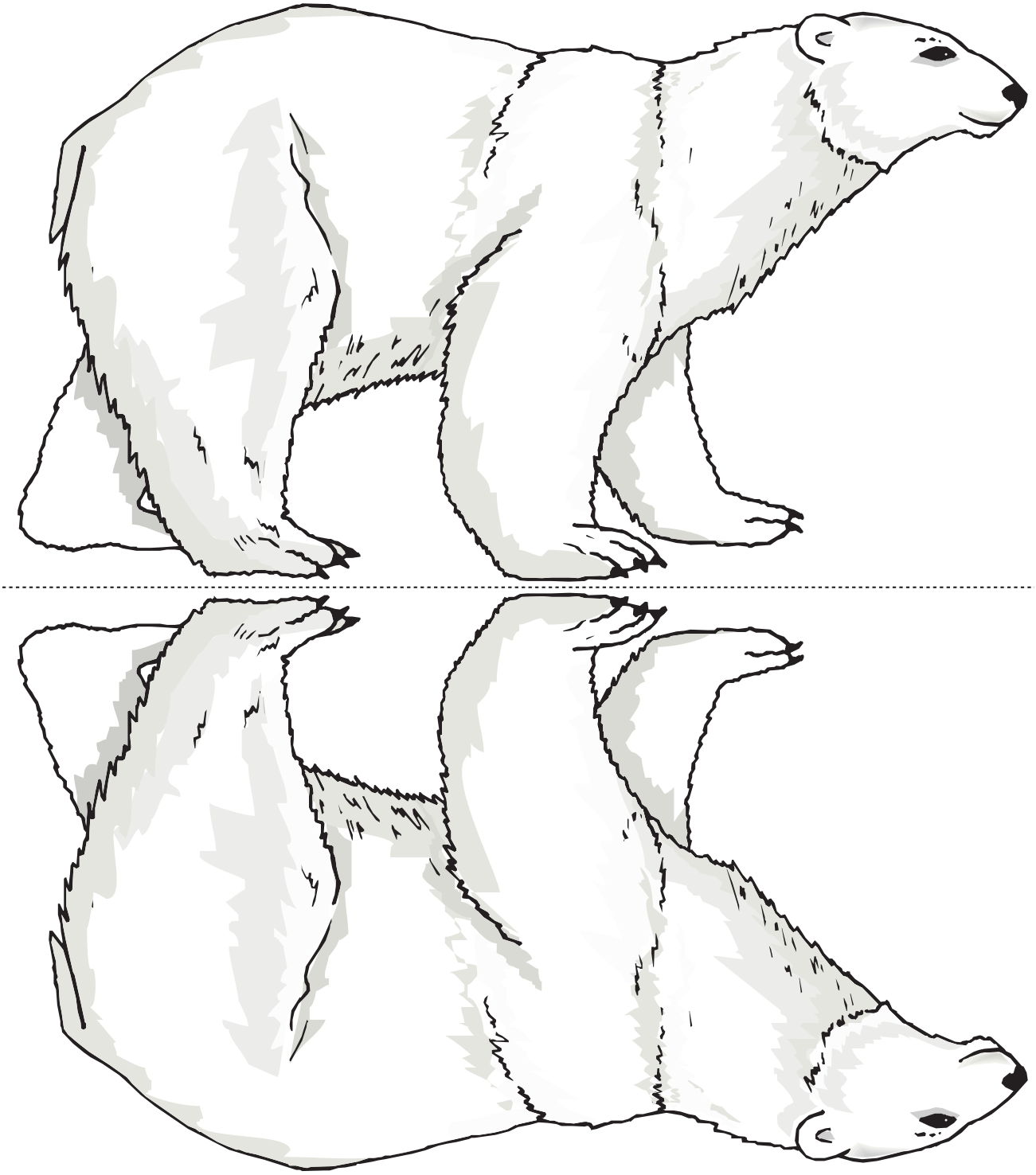
Items	Predict	Time	Result	

Name _____ Date _____

Bottling Heat



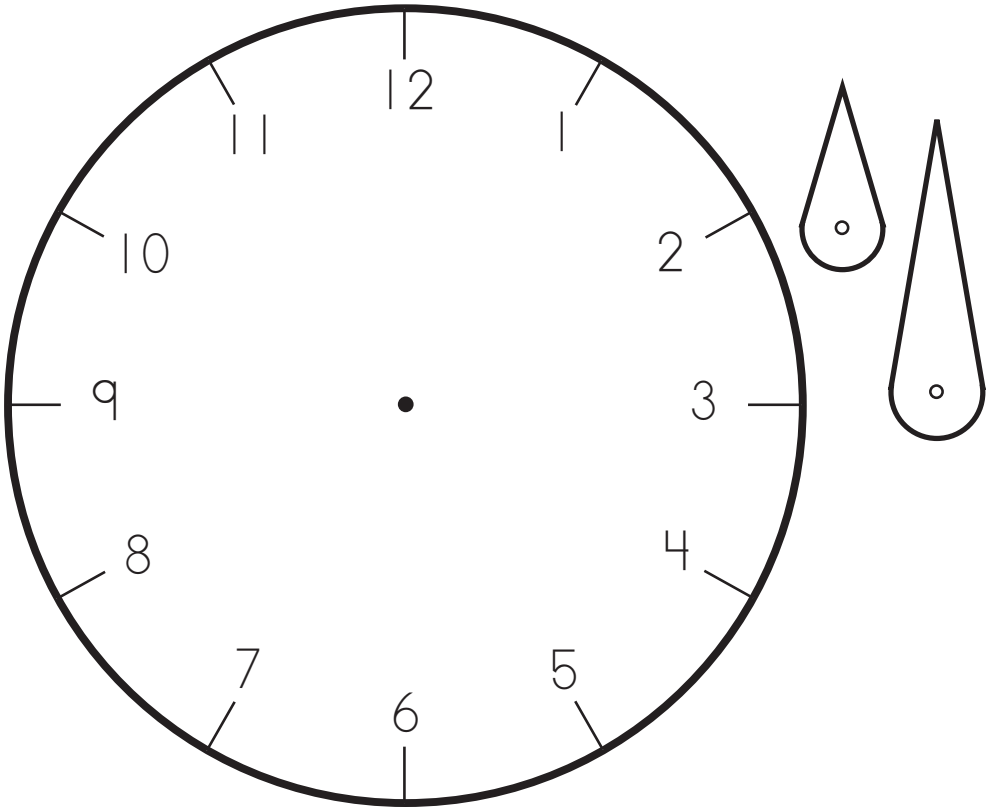
Polar Padding Pattern

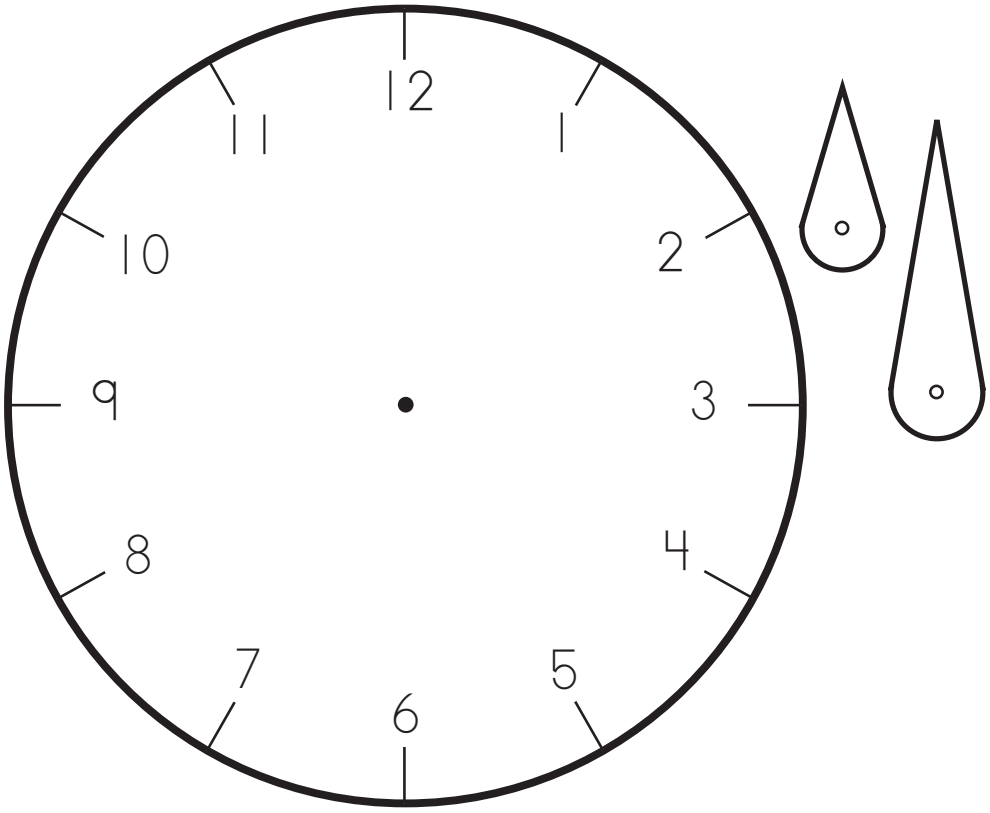


Measurement Cards

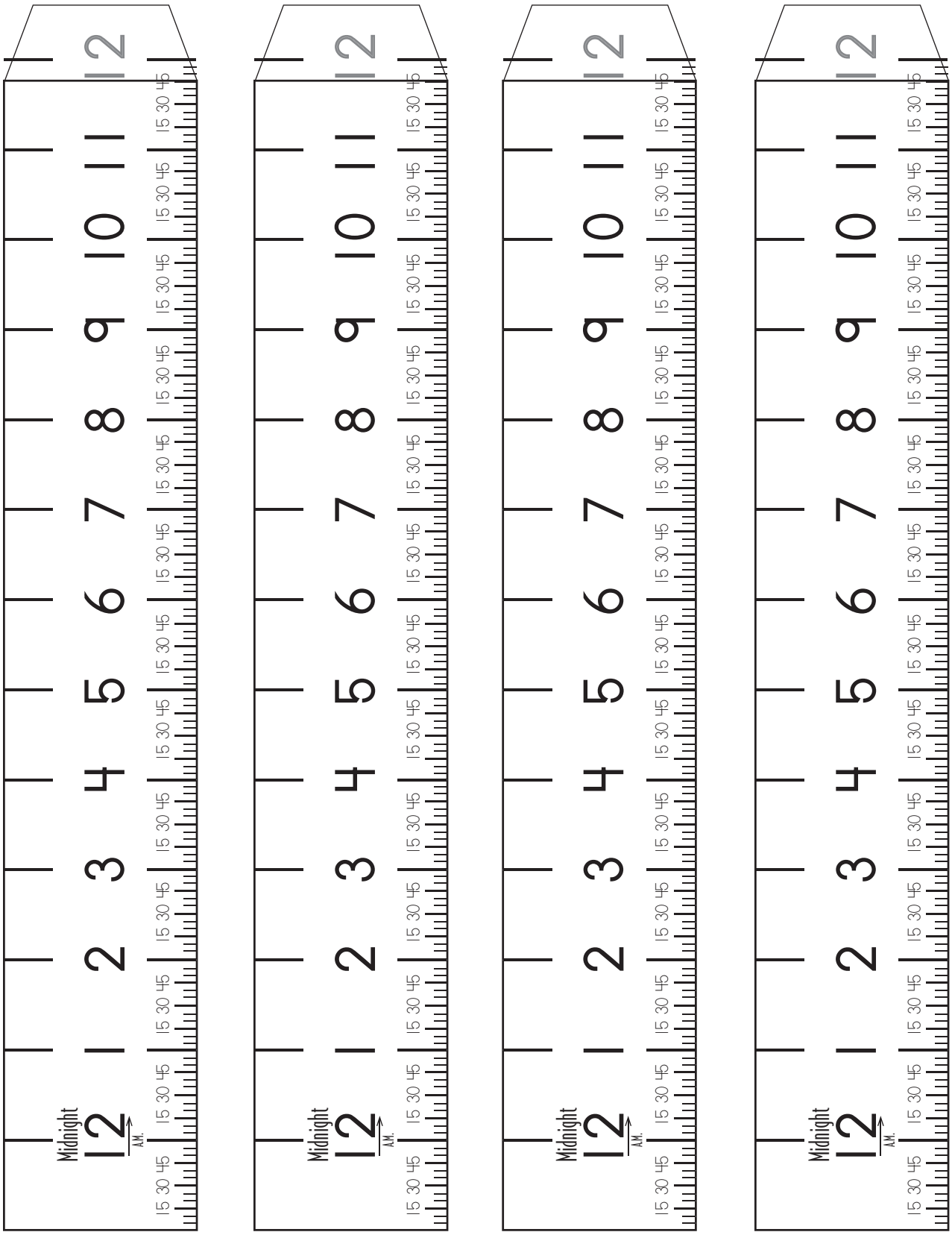
One Inch
Half Inch
One Fourth Inch
Three Fourths Inch

Wow! How Time Flies

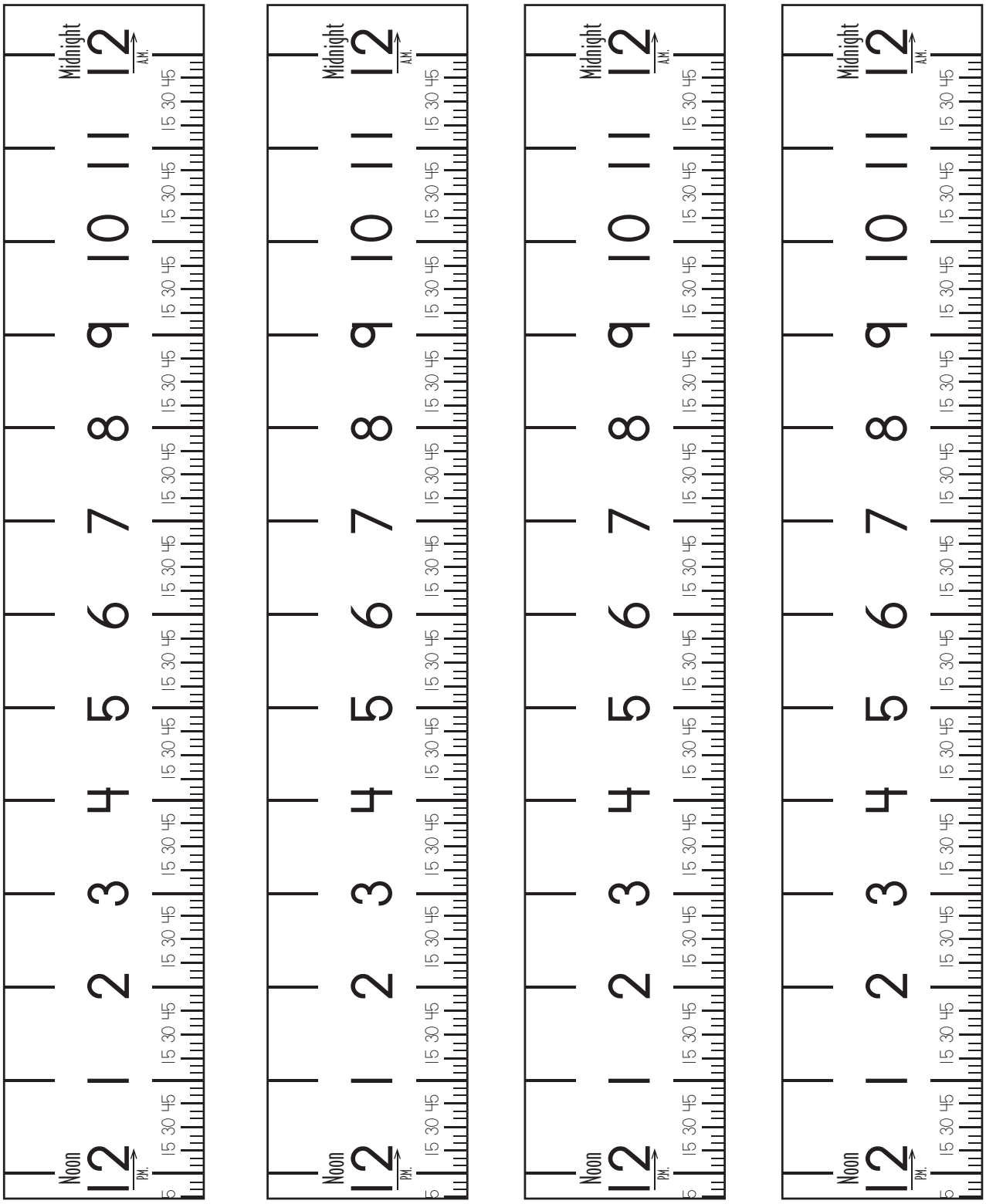




Elapsed Time Ruler



Elapsed Time Ruler



Polar Projection of the Earth