ELEMENTARY
CORE Academy

UTAH STATE OFFICE OF EDUCATION & UTAH STATE UNIVERSITY

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)
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State Mathematics Education Coordination Committee (SMECC)
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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 important is the thousands of teachers who take time from their summer to attend these professional development workshops. It is these teachers who make this program possible.

Goals of the Elementary CORE Academy

Overall

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

The Academy will provide elementary teachers in Utah with:

1. Models of exemplary and innovative instructional strategies, tools, and resources to meet 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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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.

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.

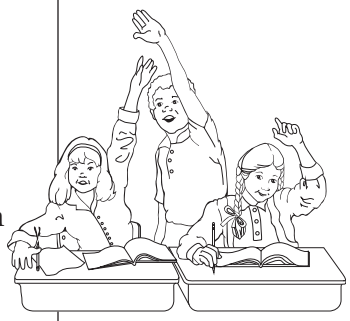
ILOs for mathematics:

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.

Fourth Grade Mathematics Core Curriculum

By the end of grade four, students develop quick recall of the basic multiplication facts and related division facts. They develop fluency with efficient procedures for multiplying multidigit whole numbers, understand why the procedures work, and use them to solve problems. Students recognize decimal notation as an extension of the base-ten system. They relate their understanding of fractions to decimals. They generate equivalent fractions, simplify fractions, and identify equivalent fractions and decimals; compare and order whole numbers, simple fractions, and decimals to hundredths; and estimate decimal or fractional amounts in problem solving.

Students use transformations, including those that produce line and rotational symmetry. Students understand area as a measurable attribute of two-dimensional regions. They select appropriate units, strategies, and tools for solving problems that involve measuring area. They connect area measure to the area model for multiplication as a way to justify the formula for the area of a rectangle.

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

Objective 1: Demonstrate multiple ways to represent whole numbers and decimals, from hundredths to one million, and fractions.

a. Read and write numbers in standard and expanded form.

b. Demonstrate multiple ways to represent whole numbers and decimals by using models and symbolic representations (e.g., 36 is the same as the square of six, three dozen, or 9 x 4).

c. Identify the place and the value of a given digit in a six-digit numeral, including decimals to hundredths, and round to the nearest tenth.

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

e. Name and write a fraction to represent a portion of a unit whole, length, or set for halves, thirds, fourths, fifths, sixths, eighths, and tenths.

f. Identify and represent square numbers using models and symbols.

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

Objective 2: Analyze relationships among whole numbers, commonly used fractions, and decimals to hundredths.

a. Compare the relative size of numbers (e.g., 475 is comparable to 500; 475 is small compared to 10,000 but large compared to 98).

b. Order whole numbers up to six digits, simple fractions, and decimals using a variety of methods (e.g., number line, fraction pieces) and use the symbols <, >, and = to record the relationships.

c. Identify a number that is between two given numbers (e.g., 3.2 is between 3 and 4; find a number between 0.1 and 0.2).

d. Identify equivalences between fractions and decimals by connecting models to symbols.

e. Generate equivalent fractions and simplify fractions using models, pictures, and symbols.

Objective 3: Model and illustrate meanings of multiplication and division of whole numbers and the addition and subtraction of fractions.

a. Model multiplication (e.g., equal-sized groups, rectangular arrays, area models, equal intervals on the number line), place value, and properties of operations to represent multiplication of a one- or two-digit factor by a two-digit factor and connect the representation to an algorithm.

b. Use rectangular arrays to interpret factoring (e.g., find all rectangular arrays of 36 tiles and relate the dimensions of the arrays to factors of 36).

c. Demonstrate the mathematical relationship between multiplication and division (e.g., 3 x □= 12 is the same as 12 ÷ 3 = □and □= 4) and use that relationship to explain that division by zero is not possible.

d. Represent division of a three-digit dividend by a one-digit divisor, including whole number remainders, using a variety of methods (e.g., rectangular arrays, manipulatives, pictures), and connect the representation to an algorithm.

e. Use models to add and subtract simple fractions where one single-digit denominator is 1, 2, or 3 times the other (e.g., 2/4 + 1/4; 3/4 - 1/8).

Objective 4: Solve problems involving multiplication and division of whole numbers and addition and subtraction of simple fractions and decimals.

a. Use estimation, mental math, paper and pencil, and calculators to perform mathematical calculations and identify when to use each one appropriately.

b. Select appropriate methods to solve a single operation problem and estimate computational results or calculate them directly, depending on the context and numbers involved in a problem.

c. Write a story problem that relates to a given multiplication or division equation, and select and write a number sentence to solve a problem related to the environment.

d. Solve problems involving simple fractions and interpret the meaning of the solution (e.g., A pie has been divided into six pieces and one piece is already gone. How much of the whole pie is there when Mary comes in? If Mary takes two pieces, how much of the whole pie has she taken? How much of the pie is left?)

Objective 5: Compute problems involving multiplication and division of whole numbers and addition and subtraction of simple fractions and decimals.

a. Demonstrate quick recall of basic multiplication and division facts.

b. Multiply up to a three- digit factor by a two-digit factor with fluency, using efficient procedures.

c. Divide up to a three-digit dividend by a one-digit divisor with fluency, using efficient procedures.

d. Add and subtract decimals and simple fractions where one single-digit denominator is 1, 2, or 3 times the other (e.g., 2/4 + 1/4 = 3/4; 1/3 – 1/6 = 1/6).

Mathematical language and symbols students should use:
sum, difference, expanded form, standard form, square number, dividend, divisor, quotient, factor, product, array, multiple, numerator, denominator, sixths, eighths, tenths, equivalent, estimate, <, >, =, ≠

Exploratory Concepts and Skills

- Use concrete objects and visual models to add and subtract common decimals.
- Explore numbers less than zero by extending the number line and by using familiar applications such as temperature.
- Investigate the concept of ratio (e.g., the number of students to the number of teachers).

Standard II: Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 1: Identify, analyze, and determine rules for describing numerical patterns involving operations and nonnumerical growing patterns.

a. Analyze growing patterns using objects, pictures, numbers, and tables to determine a rule for the pattern.

b. Recognize, represent, and extend simple patterns involving multiples and other number patterns (e.g., square numbers) using objects, pictures, numbers, and tables.

c. Identify simple relationships in real-life contexts and use mathematical operations to describe the pattern (e.g., the number of legs on a given number of chairs may be determined by counting by fours or by multiplying the number of chairs by 4).

Objective 2: Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

a. Use the order of operations to evaluate, simplify, and compare mathematical expressions involving the four operations, parentheses, and the symbols <, >, and = (e.g., 2x (4 - 1) + 3; of the two quantities 7 - (3 - 2) or (7 - 3) - 2, which is greater?).

b. Express single-operation problem situations as equations and solve the equation.

c. Recognize that a symbol represents the same number throughout an equation or expression (e.g., $\Delta + \Delta = 8$; thus, $\Delta = 4$).

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

Mathematical language and symbols students should use:
growing pattern, order of operations, parentheses, inequality, expression, equation, associative property, commutative property, distributive property, zero property of multiplication, >, <, =

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 II: **Students will use patterns and relations to represent mathematical problems and number relationships.**

Standard III: Students will understand attributes and properties of plane geometric objects and spatial relationships.

Objective 1: Identify and describe attributes of two-dimensional geometric shapes.

a. Name and describe lines that are parallel, perpendicular, and intersecting.

b. Identify and describe right, acute, obtuse, and straight angles.

c. Identify and describe the radius and diameter of a circle.

d. Identify and describe figures that have line symmetry and rotational symmetry.

Objective 2: Specify locations using grids and maps.

a. Locate coordinates in the first quadrant of a coordinate grid.

b. Give the coordinates in the first quadrant of a coordinate grid.

c. Locate regions on a map of Utah.

d. Give the regions of a position on a map of Utah.

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

a. Identify a translation, rotation, or a reflection of a geometric shape.

b. Recognize that 90°, 180°, 270°, and 360° are associated, respectively, with 1/4, 1/2, 3/4, and full turns.

Mathematical language and symbols students should use:
parallel, perpendicular, intersecting lines, right angle, acute angle, obtuse angle, straight angle, circle, radius, diameter, line symmetry, rotational symmetry, coordinate, first quadrant, degree, translate, rotate, reflect, transformation

Exploratory Concepts and Skills
- Analyze results of transformations (e.g., translations, rotations, reflections) on two-dimensional shapes.
- Investigate two-dimensional representations of three-dimensional objects.

Standard III: Students will understand attributes and properties of plane geometric objects and spatial relationships.

Standard IV: **Students will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.**

Objective 1: Describe relationships among units of measure for length, capacity, and weight, and determine measurements of angles using appropriate tools.

a. Describe the relative size among metric units of length (i.e., millimeter, centimeter, meter), between metric units of capacity (i.e., milliliter, liter), and between metric units of weight (i.e., gram, kilogram).

b. Describe the relative size among customary units of capacity (i.e., cup, pint, quart, gallon).

c. Estimate and measure capacity using milliliters, liters, cups, pints, quarts, and gallons, and measure weight using grams and kilograms.

d. Recognize that angles are measured in degrees and develop benchmark angles (e.g., 45°, 60°, 120°) using 90° angles to estimate angle measurement.

e. Measure angles using a protractor or angle ruler.

Objective 2: Recognize and describe area as a measurable attribute of two-dimensional shapes and calculate area measurements.

a. Quantify area by finding the total number of same-sized units of area needed to fill the region without gaps or overlaps.

b. Recognize that a square that is 1 unit on a side is the standard unit for measuring area.

c. Develop the area formula for a rectangle and connect it with the area model for multiplication.

d. Develop and use the area formula for a right triangle by comparing with the formula for a rectangle (e.g., two of the same right triangles makes a rectangle).

e. Develop, use, and justify the relationships among area formulas of triangles and parallelograms by decomposing and comparing with areas of right triangles and rectangles.

Standard IV:
Students will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.

f. Determine possible perimeters, in whole units, for a rectangle with a fixed area, and determine possible areas when given a rectangle with a fixed perimeter.

Mathematical language and symbols students should use:
millimeter, centimeter, meter, milliliter, liter, gram, kilogram, cup, pint, quart, gallon, area, perimeter

Exploratory Concepts and Skills
- Investigate perimeter of rectangles and squares.
- Investigate area of trapezoids.

Standard V: **Students will interpret and organize collected data to make predictions, answer questions, and describe basic concepts of probability.**

Objective 1: Collect, organize, and display data to answer questions.

a. Identify a question that can be answered by collecting data.

b. Collect, read, and interpret data from tables, graphs, charts, surveys, and observations.

c. Represent data using frequency tables, bar graphs, line plots, and stem and leaf plots.

d. Identify and distinguish between clusters and outliers of a data set.

Objective 2: Describe and predict simple random outcomes.

a. Describe the results of experiments involving random outcomes as simple ratios (e.g., 4 out of 9, 4/9).

b. Conduct simple probability experiments, with and without replacement, record possible outcomes systematically, and display results in an organized way.

c. Use the results of simple probability experiments, with and without replacement, to describe the likelihood of a specific outcome in the future.

Standard V:
Students will interpret and organize collected data to make predictions, answer questions, and describe basic concepts of probability.

Mathematical language and symbols students should use:
data, line plot, line graph, bar graph, stem and leaf plot, cluster, outlier, frequency table, probability

Exploratory Concepts and Skills
- Explore minimum and maximum values for a set of data.
- Explore mean, median, mode, and range.

Utah Elementary Science Core Curriculum

Introduction

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

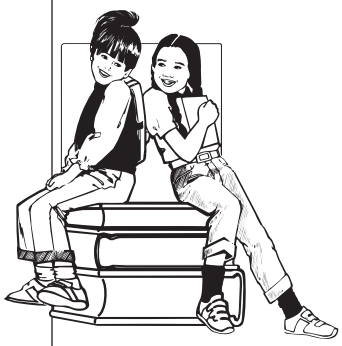
The Elementary Science Core describes what students should know and be able to do at the end of each of the K–6 grade levels. It was developed, critiqued, piloted, and revised by a community of Utah science teachers, university science educators, State Office of Education specialists, scientists, expert 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.

Eight Guidelines Were Used in Developing the Elementary Science Core

- 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

Reflects the Nature of Science

Science is a way of deciphering, 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.

Fourth Grade Science Core Curriculum

The theme for the fourth grade Science Core curriculum is **Utah natural history**. Students will learn about Utah environments including: weather, water cycle, rocks, fossils, soils, plants and animals. Understanding the concepts of **cycles** is an essential component of science literacy and is introduced at this grade level. Emphasis should be placed on skills to classify many things. Students should come to value and use science as a process of obtaining knowledge based on observable evidence, and their curiosity should be encouraged and sustained as they develop the abilities associated with inquiry in 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.

Good science instruction requires that attention be paid to providing students with hands–on science investigations in which student inquiry is an important goal. Their curiosity should be encouraged and sustained. Teachers should provide opportunities for all students to experience many things. Fourth graders should feel the excitement of a rainstorm, hunt for fossils in rocks, observe the patterns in a spider web, and teach their parents to recognize the song of the lark. They should have many opportunities to observe and predict, to infer, and to classify. They should come to enjoy science as a process of learning about their world.

Science 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. Technology issues and the nature of science are significant components of this Core. 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 fourth 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 fourth grade; the *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 fourth grade Science Core. These resources are all available on the Utah Science Home Page. 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 Fourth 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 Fourth 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.

Fourth Grade Science Standards

Science Benchmark

Matter on Earth cycles from one form to another. The cycling of matter on Earth requires energy. The cycling of water is an example of this process. The sun is the source of energy for the water cycle. Water changes state as it cycles between the atmosphere, land, and bodies of water on Earth.

Standard I: Students will understand that water changes state as it moves through the water cycle.

Standard I: Students will understand that water changes state as it moves through the water cycle.

Objective 1: Describe the relationship between heat energy, evaporation, and condensation of water on Earth.

a. Identify the relative amount and kind of water found in various locations on Earth (e.g., oceans have most of the water, glaciers and snowfields contain most fresh water).

b. Identify the sun as the source of energy that evaporates water from the surface of Earth.

c. Compare the processes of evaporation and condensation of water.

d. Investigate and record temperature data to show the effects of heat energy on changing the states of water.

Objective 2: Describe the water cycle.

a. Locate examples of evaporation and condensation in the water cycle (e.g., water evaporates when heated and clouds or dew forms when vapor is cooled).

b. Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.

c. Identify locations that hold water as it passes through the water cycle (e.g., oceans, atmosphere, fresh surface water, snow, ice, and ground water).

d. Construct a model or diagram to show how water continuously moves through the water cycle over time.

e. Describe how the water cycle relates to the water supply in your community.

Science language students should use:

vapor, precipitation, evaporation, clouds, dew, condensation, temperature, water cycle

Science Benchmark

Weather describes conditions in the atmosphere at a certain place and time. Water, energy from the sun, and wind create a cycle of changing weather. The sun's energy warms the oceans and lands at Earth's surface, creating changes in the atmosphere that cause the weather. The temperature and movement of air can be observed and measured to determine the effect on cloud formation and precipitation. Recording weather observations provides data that can be used to predict future weather conditions and establish patterns over time. Weather affects many aspects of people's lives.

Standard II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

Standard II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

Objective 1: Observe, measure, and record the basic elements of weather.

a. Identify basic cloud types (i.e., cumulus, cirrus, stratus clouds).

b. Observe, measure, and record data on the basic elements of weather over a period of time (i.e., precipitation, air temperature, wind speed and direction, and air pressure).

c. Investigate evidence that air is a substance (e.g., takes up space, moves as wind, temperature can be measured).

d. Compare the components of severe weather phenomena to normal weather conditions (e.g., thunderstorm with lightning and high winds compared to rainstorm with rain showers and breezes).

Objective 2: Interpret recorded weather data for simple patterns.

a. Observe and record effects of air temperature on precipitation (e.g., below freezing results in snow, above freezing results in rain).

b. Graph recorded data to show daily and seasonal patterns in weather.

c. Infer relationships between wind and weather change (e.g., windy days often precede changes in the weather; south

winds in Utah often precede a cold front coming from the north).

Objective 3: Evaluate weather predictions based upon observational data.

a. Identify and use the tools of a meteorologist (e.g., measure rainfall using rain gauge, measure air pressure using barometer, measure temperature using a thermometer).

b. Describe how weather and forecasts affect people's lives.

c. Predict weather and justify prediction with observable evidence.

d. Evaluate the accuracy of student and professional weather forecasts.

e. Relate weather forecast accuracy to evidence or tools used to make the forecast (e.g., feels like rain vs. barometer is dropping).

Science language students should use:

atmosphere, meteorologist, freezing, cumulus, stratus, cirrus, air pressure, thermometer, air temperature, wind speed, forecast, severe, phenomena, precipitation, seasonal, accuracy, barometer, rain gauge, components

Science Benchmark

Earth materials include rocks, soils, water, and gases. Rock is composed of minerals. Earth materials change over time from one form to another. These changes require energy. Erosion is the movement of materials and weathering is the breakage of bedrock and larger rocks into smaller rocks and soil materials. Soil is continually being formed from weathered rock and plant remains. Soil contains many living organisms. Plants generally get water and minerals from soil.

Standard III: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Standard III: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 1: Identify basic properties of minerals and rocks.

a. Describe the differences between minerals and rocks.

b. Observe rocks using a magnifying glass and draw shapes and colors of the minerals.

c. Sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic (e.g., sedimentary—rounded-appearing mineral and rock particles that are cemented together, often in layers; igneous—with or without observable crystals that are not in layers or with or without air holes or glasslike; metamorphic—crystals/minerals, often in layers).

d. Classify common rocks found in Utah as sedimentary (i.e., sandstone, conglomerate, shale), igneous (i.e., basalt, granite, obsidian, pumice) and metamorphic (i.e., marble, gneiss, schist).

Objective 2: Explain how the processes of weathering and erosion change and move materials that become soil.

a. Identify the processes of physical weathering that break down rocks at Earth's surface (i.e., water movement, freezing, plant growth, wind).

b. Distinguish between weathering (i.e., wearing down and breaking of rock surfaces) and erosion (i.e., the movement of materials).

c. Model erosion of Earth materials and collection of these materials as part of the process that leads to soil (e.g., water moving sand in a playground area and depositing this sand in another area).

d. Investigate layers of soil in the local area and predict the sources of the sand and rocks in the soil.

Objective 3: Observe the basic components of soil and relate the components to plant growth.

a. Observe and list the components of soil (i.e., minerals, rocks, air, water, living and dead organisms) and distinguish between the living, nonliving, and once living components of soil.

b. Diagram or model a soil profile showing topsoil, subsoil, and bedrock, and how the layers differ in composition.

c. Relate the components of soils to the growth of plants in soil (e.g., mineral nutrients, water).

d. Explain how plants may help control the erosion of soil.

e. Research and investigate ways to provide mineral nutrients for plants to grow without soil (e.g., grow plants in wet towels, grow plants in wet gravel, grow plants in water).

Science language students should use:

mineral, weathering, erosion, sedimentary, igneous, metamorphic, topsoil, subsoil, bedrock, organism, freeze, thaw, profile, nonliving, structural support, nutrients

Science Benchmark

Fossils are evidence of living organisms from the past and are usually preserved in sedimentary rocks. A fossil may be an impression left in sediments, the preserved remains of an organism, or a trace mark showing that an organism once existed. Fossils are usually made from the hard parts of an organism because soft parts decay quickly. Fossils provide clues to Earth's history. They provide evidence that can be used to make inferences about past environments. Fossils can be compared to one another, to living organisms, and to organisms that lived long ago.

Standard IV: Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

Standard IV: Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

Objective 1: Describe Utah fossils and explain how they were formed.

a. Identify features of fossils that can be used to compare them to living organisms that are familiar (e.g., shape, size and structure of skeleton, patterns of leaves).

b. Describe three ways fossils are formed in sedimentary rock (i.e., preserved organisms, mineral replacement of organisms, impressions or tracks).

c. Research locations where fossils are found in Utah and construct a simple fossil map.

Objective 2: Explain how fossils can be used to make inferences about past life, climate, geology, and environments.

a. Explain why fossils are usually found in sedimentary rock.

b. Based on the fossils found in various locations, infer how Utah environments have changed over time (e.g., trilobite fossils indicate that Millard County was once covered by a large shallow ocean; dinosaur fossils and coal indicate that Emery and Uintah County were once tropical and swampy).

c. Research information on two scientific explanations for the extinction of dinosaurs and other prehistoric organisms.

d. Formulate questions that can be answered using information gathered on the extinction of dinosaurs

Science language students should use:

infer, environments, climate, dinosaur, preserved, extinct, extinction, impression, fossil, prehistoric, mineral, organism, replacement, trilobite, sedimentary, tropical

Science Benchmark

Utah has diverse plant and animal life that is adapted to and interacts in areas that can be described as wetlands, forests, and deserts. The characteristics of the wetlands, forests, and deserts influence which plants and animals survive best there. Living and nonliving things in these areas are classified based on physical features.

Standard V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Standard V:
Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 1: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

a. Compare the physical characteristics (e.g., precipitation, temperature, and surface terrain) of Utah's wetlands, forests, and deserts.

b. Describe Utah's wetlands (e.g., river, lake, stream, and marsh areas where water is a major feature of the environment) forests (e.g., oak, pine, aspen, juniper areas where trees are a major feature of the environment), and deserts (e.g., areas where the lack of water provided an environment where plants needing little water are a major feature of the environment).

c. Locate examples of areas that have characteristics of wetlands, forests, or deserts in Utah.

d. Based upon information gathered, classify areas of Utah that are generally identified as wetlands, forests, or deserts.

e. Create models of wetlands, forests, and deserts.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

a. Identify common plants and animals that inhabit Utah's forests, wetlands, and deserts.

b. Cite examples of physical features that allow particular plants and animals to live in specific environments (e.g., duck has webbed feet, cactus has waxy coating).

c. Describe some of the interactions between animals and plants of a given environment (e.g., woodpecker eats insects that live on trees of a forest, brine shrimp of the Great Salt Lake eat algae and birds feed on brine shrimp).

d. Identify the effect elevation has on types of plants and animals that live in a specific wetland, forest, or desert.

e. Find examples of endangered Utah plants and animals and describe steps being taken to protect them.

Objective 3: Use a simple scheme to classify Utah plants and animals.

a. Explain how scientists use classification schemes.

b. Use a simple classification system to classify unfamiliar Utah plants or animals (e.g., fish/amphibians/reptile/bird/mammal, invertebrate/vertebrate, tree/shrub/grass, deciduous/conifers).

Objective 4: Observe and record the behavior of Utah animals.

a. Observe and record the behavior of birds (e.g., caring for young, obtaining food, surviving winter).

b. Describe how the behavior and adaptations of Utah mammals help them survive winter (e.g., obtaining food, building homes, hibernation, migration).

c. Research and report on the behavior of a species of Utah fish (e.g., feeding on the bottom or surface, time of year and movement of fish to spawn, types of food and how it is obtained).

d. Compare the structure and behavior of Utah amphibians and reptiles.

e. Use simple classification schemes to sort Utah's common insects and spiders.

Science language students should use:

wetland, forest, desert, adaptation, deciduous, coniferous, invertebrate, vertebrate, bird, amphibian, reptile, fish, mammal, insect, hibernation, migration

Common plants:

sagebrush, pinyon pine, Utah juniper, spruce, fir, oak brush, quaking aspen, cottonwood, cattail, bulrush, prickly pear cactus

Common animals:

jackrabbit, cottontail rabbit, red fox, coyote, mule deer, elk, moose, cougar, bobcat, deer mouse, kangaroo rat, muskrat, beaver, gopher snake, rattlesnake, lizard, tortoise, frog, salamander, red–tailed hawk, barn owl, lark, robin, pinyon jay, magpie, crow, trout, catfish, carp, grasshopper, ant, moth, butterfly, housefly, bee, wasp, pill bug, millipede

Facilitated

Activities

Name _____ District _____

Quadrant Partner

1.	2.
3.	4.

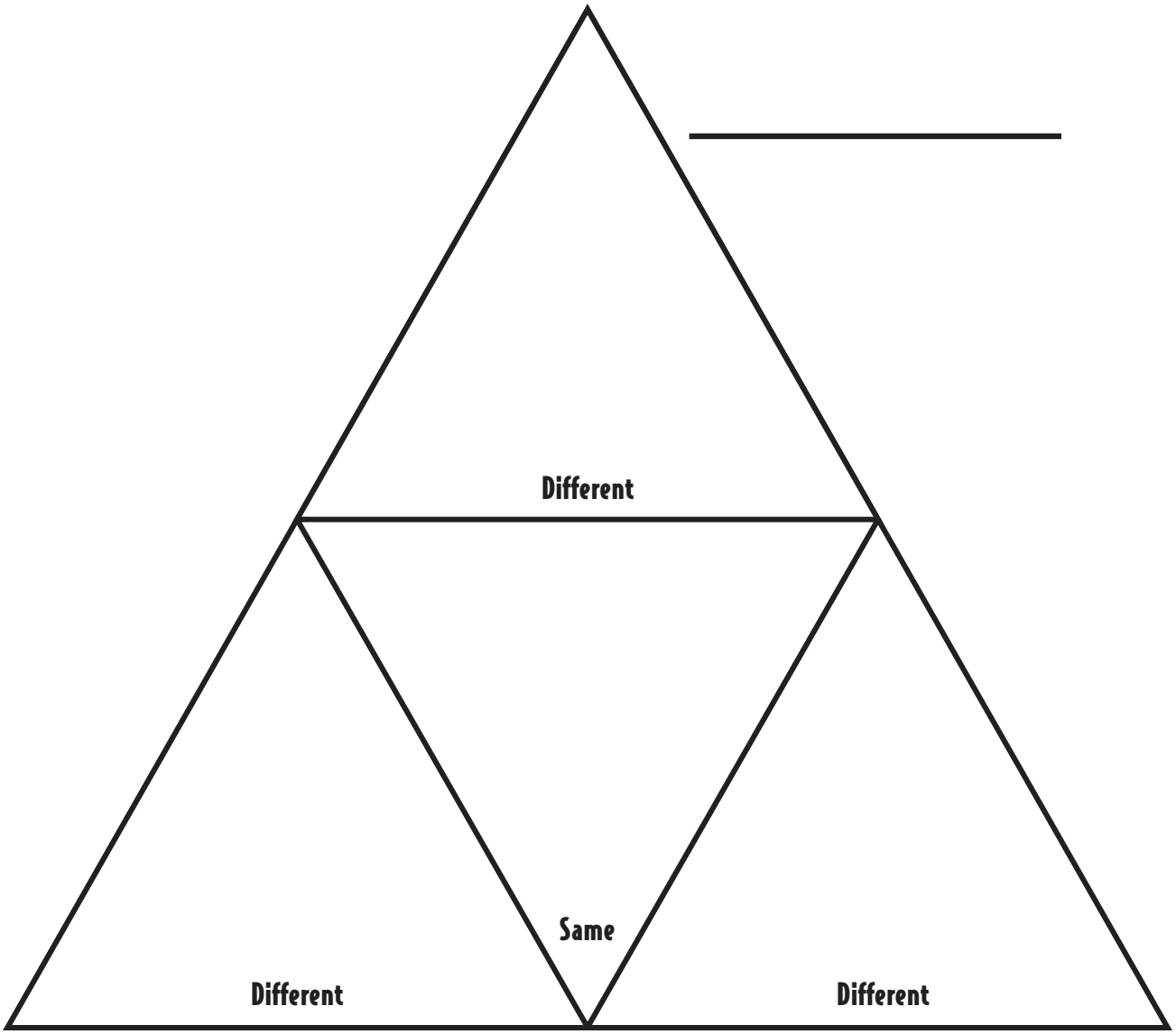
Name _____ Date _____

Compare and Contrast

How Are They Alike?

How Are They Different?	How Are They Different?	How Are They Different?

Triangle Compare and Contrast



Name _____ Date _____

Rectangle Compare and Contrast

_____ _____

Different	Same	Different

Science Journaling Rubric

	4	3	2	1
Organization & Presentation	- Main idea clearly evident - Ideas supported by information and logic - Effective use of text structures to communicate information - Conclusion	- Main idea presented - Ideas are presented, but need more clarification - Conclusions are somewhat logical - Text structures evident	- Main idea stated but unclear - Ideas are either inaccurate or missing - Inappropriate conclusions - Text structures show misconceptions	- No main idea - Much information missing - Little effort evident - No text structures or used incorrectly
Use of Science Language	Consistent use of appropriate science language and terminology	Uses appropriate science language with minor errors	Partial use of science language (3+errors) or terminology	Inaccurate use of science language and terminology
Science Content	- Accurate and complete - Interesting with information in many areas - Makes connections	- Accurate with minor mistakes - Connections are evident but show minor growth or misconceptions	- Information is somewhat complete - Shows few connections	- Inaccurate science - No connections
Conventions	- Journal shows attention to spelling capitalization Careful, detailed - Excellent	- Journal shows minor errors that do not prevent reader from understanding content - Good	- Journal shows many errors, but some effort to try that is evident in reading - Fair	- Journal shows little effort or attention to detail or proof-reading - Confusing to read

Math Journal Rubric

NEATNESS	5 All pages are neat. Appropriate spacing is used. Handwriting is legible. Drawings are neat. No doodling.	3 Some pages are neat. Spacing is used. Handwriting is somewhat legible. Drawings are understandable. Little or no doodling.	1 Messy hard to read. Lots of doodling.
ORDER	5 All notes, activities, and assignments are clearly marked (using capital letters and underlines) and dated. Each section is in the correct order.	3 Some notes, activities, and assignments are clearly marked (using capital letters and underlines) and dated. Each section is in the correct order.	1 No order. Things are hard to find.
COMPLETENESS	5 All notes, activities, and assignments are completed.	3 Some notes, activities, and assignments are completed.	1 Few notes, activities, and assignments are completed.

Total Points: _____

Comments: _____

_____

_____

Construction Scoring Rubrics

What is a Rubric?

- It is a tool developed by teachers to assess students' understanding/performance.
- It lists the tasks to be evaluated and the specific criteria used to evaluate each task.
- It is more than a simple check list; it describes the levels of quality for each task.

Why Use a Rubric?

- Rubrics are used when assessments are subjective.
- Rubrics make instructors' expectations clear to students.
- Rubrics show students how to meet expectations.
- Rubrics help students evaluate the quality of their work.
- Rubrics improve the consistency and objectivity of grading.
- Rubrics may reduce the time it takes to grade.

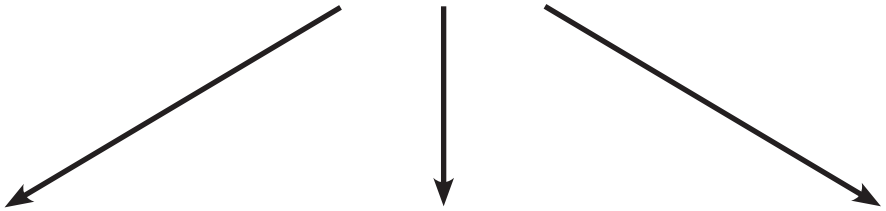
How to Create a Rubric:

- Record the performance objectives.
- Identify the tasks.
- Identify the levels of quality.
- Assign a point value to each level.
- Identify the criteria for each level.
- Create the rubric table.

Differentiating Instruction

How a teacher responds to individual learning need is determined by basic principles of differentiation

Differentiation Principles



Appropriate Task Assignment | Flexible Groups | Formative Assessment Practices

Differentiate Instruction Based On:

Content — Process — Product

While Aligning Students, Consider

Readiness — Interests — Learning Style

Use Multiple Delivery Techniques and Strategies Such As

Tool Bag
Jig Saw
Varied Texts
Literature Circles

Multiple Intelligences/Learning Styles

Children think, learn, and create in a myriad of different ways. Howard Gardner's model of multiple intelligences recognizes the broad range of talents and learning styles we find in our students. Within his model, Gardner identified and categorized eight different intelligences: verbal/linguistic, logical/mathematical, bodily/kinesthetic, intrapersonal, interpersonal, musical/rhythmic, visual/spatial, and naturalistic. According to Gardner, every child possesses each of these intelligences, but some are developed more than others, depending on the individual. Teachers can take these categories and differentiate curriculum through the preparation of activities that nurture these intelligences in students. Indeed, the development of each child's potential is directly influenced by how effectively teachers match what students learn with how they learn (their own particular intelligences).

It is recommended that teachers use the eight multiple intelligences as a springboard to create activities that challenge students to take control of their own learning. Making students aware of the different intelligences will help them identify how they learn best and which methods challenge them. Teachers can target activities that lead students to enhance both their strengths and weaknesses.

Indeed, educators can think of multiple intelligences as a philosophy of how children learn. University of California—Riverside's Sue Teele describes the goal of Gardner's model in this way: "Multiple intelligences provide for different windows into the same room. We need to unleash the creative potential in all our schools in order to open as many windows as possible for every student in every classroom to succeed . . .the future mandates that we all move forward together in a way that builds on both our mutual strengths and respects our unique differences."

Teele's research suggests that certain intelligences are stronger in students, depending on their stages of development. Using a survey she developed, the "Teele Inventory for Multiple Intelligences". Sue studied the learning preferences of more than 6,000 students. Her findings revealed that the verbal/linguistic intelligence is strongest in students in kindergarten through third grade. First through fourth grade students show a definite preference for the logical/mathematical intelligence. The visual/spatial and bodily/kinesthetic intelligences are dominant throughout both elementary and middle school. Middle school students also show a preference for the musical/rhythmic and interpersonal intelligences. Based on Teele's findings, elementary school teachers would be well advised to plan lessons that incorporate the use of verbal/linguistic, logical/mathematical, visual/spatial and bodily/kinesthetic activities.

Here are a few considerations for educators as they strive to create activities based on the different learning styles of their students:

- **Change it up.** Educators should choose activities that target varied intelligences. Since teachers tend to plan lessons and activities that fit their own learning preferences, it's important for them to self-assess and to be sure that all of the intelligences are being represented.
- **Be clear**. When differentiating the "product," teachers need to be sure that students have clear directions (task cards, or posted instructions). Also, routines/procedures should be

established for students so they know how/where to find materials and who/when to ask for help.

- **Be realistic**. It's not necessary or appropriate for teachers to use all eight intelligences in every lesson. During the planning phase, the Core Curriculum and unique needs of the students should be considered to determine which two or three to incorporate.
- **Remember to reflect**. Best practice suggests that after trying something new, professionals take time to reflect, including notes of what to retain and what to refine.
- **All in good time.** It can be overwhelming for teachers to create activities that incorporate the multiple intelligences in every single lesson for every content area. Common sense suggests to start with "baby steps" and consult with colleagues for ideas throughout the process.
- **Communicate with parents**. Both students and their parents will appreciate the insights that come from recognizing and putting a name to their unique learning styles. In fact, teachers can invite parents to help students identify their preferences by sending home a Learning Preferences Survey to be completed by students and parents together (each horizontal row represents a learning style/intelligence).

References:

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.

Teele, S. (1994). Redesigning the educational system to enable all students to succeed. Doctoral dissertation, University of California—Riverside.

Resources:

http://www.thomasarmstrong.com/multiple_intelligences.htm

http://en.wikipedia.org/wiki/Multiple_Intelligences

Gardner's Eight Multiple Intelligences

Intelligence	Student Likes	Student Needs
Verbal/Linguistic "word smart" The student thinks in words.	Words: writing, reading, playing word games, telling interesting stories	journals, books, writing materials
Logical/Mathematical "number/reasoning smart" The student thinks by reasoning.	Numbers or logic: figuring out problems, doing puzzles, experimenting, calculating	science supplies, trips to museums, math manipulatives
Visual/Spatial "picture smart" The student thinks in pictures.	Pictures: drawing, designing, doodling	art supplies, building materials, video equipment, puzzles
Bodily/Kinesthetic "body smart" The student thinks by using his/her body.	A physical experience: dancing, moving, jumping, running, touching	movement, sports, theater, physical games, hands-on activities
Rhythmic/Musical "music smart" The student thinks in melodies and rhythms.	Music: listening to music, making own music, tapping to the rhythm, singing	musical instruments, concerts, karaoke machine
Interpersonal "people smart" The student thinks by talking about his/her ideas to others.	A social experience: organizing events, being the leader, partying, mediating between friends	time with friends, group projects, social events
Intrapersonal "self-smart" The student keeps his/her thoughts to him/herself.	Self-reflection: setting goals, mediating, daydreaming, quiet places	time alone, individualized projects
Naturalist "nature smart" The student thinks by classifying.	An experience in the natural world: studying anything in nature including rocks, animals, plants, and the weather	time outside, nature hikes, telescopes, binoculars, notebooks for classification

Learning Preferences Survey

Dear Parents/Guardians,

It is an honor to be teaching your child, along with a whole class of unique and wonderful fourth-graders! Knowing my students' learning styles will help me plan and prepare learning experiences to enhance their natural talents/interests and to encourage the development of additional skills.

Please take a moment to complete this survey with your child. Thank you for your time. It is a pleasure to work with you!

Sincerely,

Directions: Read each box. Highlight with a crayon/pen/marker to identify the ones your child likes.

reading stories	writing stories	telling stories	spelling	doing word searches	word games
math problems	counting	playing checkers	measuring things	making graphs	science experiments
puzzles	drawing	painting	making sculptures	looking at maps	building blocks
playing sports	hiking	acting	moving around	dancing	running
playing instruments	humming tunes	writing songs	listening to music	singing	clapping rhythms
playing games with others	group work	being the leader	talking to people	talking on the phone	planning parties
keeping a journal	setting goals	quiet time for thinking	time alone	reading alone	daydreaming
animals	nature	learning about weather	watching animals	the outdoors	plants

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, does not mean that they should be given more work.
- Just because students are below grade level, does not mean that 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.

Tic-Tac-Toe Menu

Choose three activities from the menu that will give you a winning game. Check off each activity as you complete it. Draw a straight line through all three when you are finished.

(Mathematical/Logical) Write a mathematical expression that equals the number of hours you have spent in CORE Academy over the years.	(Linguistic/Verbal) Choose a word from either "Science language students should use" or "mathematical language students should use" and use it in a tongue twister that demonstrates your understanding of the word.	(Body/Kinesthetic) Write a fraction addition or subtraction problem that could be acted out or modeled by students.
(Visual/Spatial) Draw a picture with at least 5 angles in it. Measure and record the degrees in each angle.	Free Choice Make up your own activity dealing with CORE Academy.	(Intrapersonal) In your journal list 5 things you have learned this year in CORE Academy that you want to be sure and remember or use this coming year.
(Interpersonal) Working with at least one other person, fill in the blanks to make a CORE Academy joke. 185 _____ go into a bar, the bartender says, "We don't serve _____ in here. The 185 _____ say, "_____."	(Musical) Write a jingle for a CORE Academy TV commercial.	(Naturalistic) Make a list of 6 activities you can use to get your students outside to explore science or math.

RAFT Options

Role	Audience	Format	Topic
Yourself	Your spouse and children	Note attached to the refrigerator door	Job assignments for children, what to fix for lunch, and who to call in case of an emergency while you are at CORE Academy
4th Grade Student	A classmate	Playground discussion	My favorite subject in school
Principal	Teachers at a Faculty meeting	Power Point presentation	The school's end of level testing, and AYP results
Parent	Son or daughter's teacher	Parent teacher conference	My child is so excited about….
The Teacher Next Door	Students	A bulletin board	Purple Monkeys Do Awesome Summersaults
Janitor	Sweeper	Note taped to vacuum	Ms. Brown did science again today….!
First Year Teacher	Self	Journal entry dated the day before school starts for the year	HELP….
Thirty Year Veteran Teacher	Self	Conversation to self on drive to school for the first day of the year	HELP….
Your Child	God	Prayer	Please help mommy/ daddy's school make AYP this year….
Your Spouse	You	Cell phone conversation during CORE Academy session	Johnny did what?!

Tic Menu

Choose one task and complete it, then begin another task of your team's choice.

RAFT Options With your team choose an objective or standard from the math or science CORE and brainstorm as many different Roles, (with accompanying Audience, Format, and Topic,) as you can that apply to the objective. Record your team's ideas in your journal.	Tic-Tac-Toe Menus In your journal, label a page for each of the 8 Multiple Intelligences. With your team, choose an objective or standard from the science or math CORE. Begin writing tasks for each of the intelligences that could be used on a menu.	Menu or RAFT With your team, choose an objective or standard from the science or math core and make a Tic-Tac-Toe Menu or RAFT that could be taken back to your classroom and used next year.

Math IV-1
Activities

Measurement

Angles, Degrees, Protractors...Oh My!

Standard IV:

Student will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.

Objective 1:

Describe relationships among units of measure for length, capacity, and weight, and determine measurements of angles using appropriate tools.

Intended Learning Outcomes:

2. Become mathematical problem solvers.
4. Communicate mathematically.

Content Connections:

Math III-1; Recognize angle degree
Oral Language IV-1; Communicate by listening, speaking, and viewing

Math Standard IV

Objective 1

Connections

Background Information

The protractor is an instrument of measurement. A protractor is used to construct and measure angles. The simple protractor is an ancient device used for plotting the position of boats on navigational charts. There are different kinds of protractors, but the one used in elementary school is called a simple protractor. We have units for measuring angles and they are called degrees. These are not the same as temperature degrees, even though the same word is used. The simple protractor looks like a semicircular disk marked with degrees, from 0º to 180º.

Angles are formed when two rays intersect. Angles are measured in degrees. A complete circle measures 360 degrees. If you take a circle and cut it into 360 slices, each of those slices is one degree. Why 360 degrees? Historians believe this is because old calendars, such as the Persian Calendar, used 360 days for a year. When they watched the stars they saw them revolve around the North Star one degree per day. This ancient measurement is still recognized today as the measurement of a circle.

To adequately use and understand using a protractor, students need to have background knowledge of the following vocabulary: angle, acute, obtuse, right, straight, reflex, vertex, and arms.

Students in 4th grade need to recognize benchmark angles:

90 degree angel= ¼ of a circle

180 degree angle = ½ of a circle

270 degree angle = ¾ of a circle

360 degrees = full circle

Research Basis

Van Hiele, P. M. (1999, February). Developing geometric thinking through activities that begin with play. *Teaching Children Mathematics*, 5 (6), 310-316.

"For children, geometry begins with play," writes Pierre van Hiele (1999). He goes on to say that for students to reach the higher levels of geometric thinking, their instruction should still begin with an exploratory phase, gradually building concepts and related language, and culminating in summary activities that help students integrate what they have learned into what they already know."

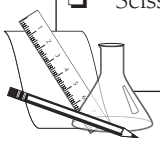
Ernest, P.S. (1994). E*valuation of the effectiveness and implementation of a math manipulatives project*. (Report No. SE-057 682). Nashville, TN: Annual Meeting of the Mid-South Educational Research Association. (ERIC Document Reproduction Service No. ED 391 675).

The purpose of manipulatives would be to allow students to learn a geometric principle in more than one way. In other words, instead of just hearing about a math principle, they also get to see and feel it. The study confirms that students are more willing to participate, and experiment in math projects. Their attitudes towards math improved, thus raising their self-confidence in their math ability.

Invitation to Learn

Materials

- ❑ *Mystery Word*
- ❑ Scissors



Place the strip of pre-printed letters on each student's desk. The students will cut the letters apart and manipulate the letters until they figure out what the mystery word is. Instruct students when they discover the mystery word to write it down on a piece of paper and wait for teacher to verify the word.

R C R P T R T O A O (Protractor)

After all students have discovered the mystery word, protractor, introduce the protractor lesson.

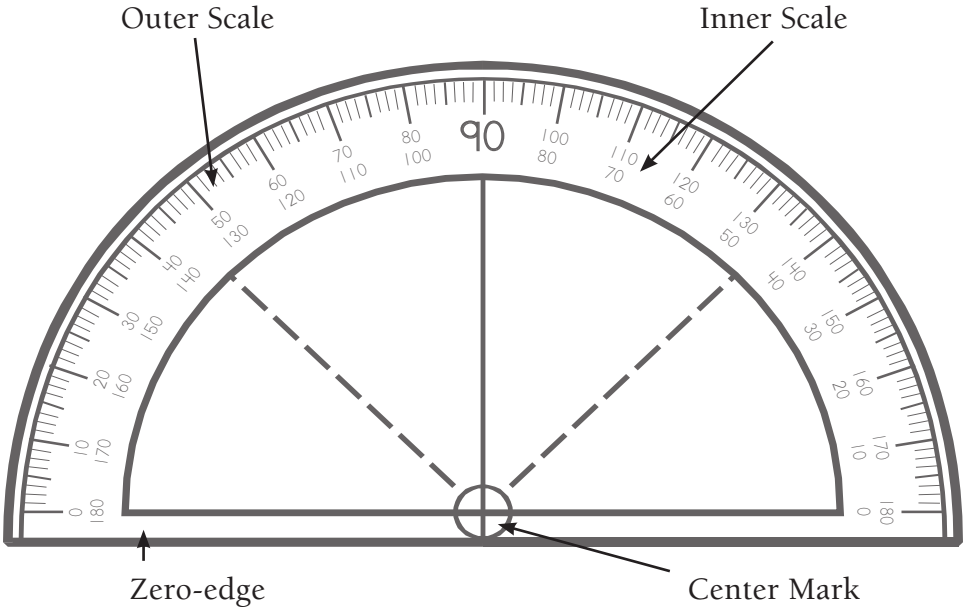
Instructional Procedures

Materials

- ❑ *Label a Protractor*
- ❑ Overhead protractor
- ❑ Overhead projector
- ❑ Math Journal
- ❑ Scissors
- ❑ Glue

Using a Protractor

1. The teacher will demonstrate how to read and label a protractor. (overhead protractor).
2. Cut out preprinted protractor. Glue in math journal.
3. The students will record how to read and label a protractor in their journal.
4. Points to label: outer scale, inner scale, center mark and zero-edge.



Cut out the protractor and place in Math Journals. Divide the page into 4 equal sections. Label the sections with the following headings. Review and discuss how to label. Record directions in journal.

Zero-Edge The zero-edge is always at the same level as the 0 mark.	**Center Mark** The center mark is always at the middle of the zero-edge.
Inner Scale The numbers on the inner edge of the protractor.	**Outer Scale** The numbers on the outer edge of the protractor.

Classroom Protractors

Fourth grade students generally find it difficult to read and calculate the degree marks accurately. A "homemade" protractor (with a dark thread) helps eliminate this problem. Manipulating the thread to lay on the exact degree, helps the students identify the exact degree on the protractor.

Materials

- ❑ *Making My Protractor*
- ❑ Needle
- ❑ Thread
- ❑ Scissors
- ❑ *What's My Angle*

Constructing a Student Protractor

1. Cut out laminated protractor.
2. Thread needle and tie knot at end.
3. Bring needle up through the center mark on the protractor. Tape thread securely in place.
4. Students will manipulate the thread to line up with the angle to be measured.
5. Use the angle worksheet to practice measuring angles.

To Measure an Angle

1. Find the center mark on the straight edge of the protractor.
2. Place the hole over the vertex, or point, of the angle you wish to measure.
3. Line up the zero on the straight edge of the protractor with one of the sides of angle.
4. Find the point where the second side of angle intersects the curved edge of the protractor.
5. Place the thread on the second angle line.
6. Read the number that is written on the protractor at the point of intersection. This is the measurement of the angle in degrees.
7. There are two sets of scales on the protractor, an outer scale and inner scale. The degrees start at 0 on the straight edge, each going in opposite directions. The lines are the same so when naming angles make sure you identify which angle is being measured.

Constructing an Angle

1. Use the straight edge of the protractor to draw a straight line. This line will form one side of your angle.
2. Find the center hole on the straight edge of the protractor.
3. Place the hole over one end point of the line you have drawn.
4. Line up the zero on the straight edge of the protractor with the line.
5. Make a mark at the number on the curved edge of the protractor that corresponds to the desired measure of our angle. For example, mark at 90 for a 90 degree angle
6. Use the straight edge of the protractor to connect the mark to the end point of the first line, forming an angle.

Independent Practice

1. The protractor worksheet *What's My Angle* is given to each student.
2. Students will classify angles as acute, straight, obtuse or right.
3. Guide students in measuring various angles.
4. Record the measurements and type of angle on the worksheet.
5. Group students in pairs to check each other's work.
6. Next, on reverse side of worksheet, students will draw 3 angles to be measured by the other student.
7. Teacher will assess for accuracy.

What's My Name Worth?

1. How much is a first name worth? Calculate the value of your name by identifying angles. Start this activity by showing the class the "angle price list."

   acute angles = 10 cents each

   obtuse angles = 8 cents each

   right angles = 5 cents each

   vertical lines = 3 cents each

   horizontal lines = 2 cents each

   diagonal lines = 1 cent each
2. Each student will use the preprinted alphabet to print his/her first name in capital letters.
3. The student then examines the name for obtuse angles, acute angles, right angles, vertical lines and horizontal lines.
4. Next the student adds the various amounts and comes up with a total.

Example:

J A N E

5 acute angles @ 10 cents each =	$.50
2 obtuse angles @ 8 cents each =	.16
4 right angles @ 5 cents each =	.20
4 vertical lines @ 3 cents each =	.12
4 horizontal lines @ 2 cents each =	.08
1 diagonal lines @ 1 cent each =	.01
	$1.07

Assessment Suggestions

- Students draw and measure angles.
- Formal assessment requiring identifying angle type, degrees, and vocabulary.

Curriculum Extensions/Adaptations/ Integration

- Students make angles using the Semaphore flag system. Semaphore Fun visit: http://en.wikipedia.org/wiki/Image:Semaphore_Yankee.svg
- Students make angles any way they can without using pencil and paper, such as a "people" Clock or drawing/manipulating the hands of a clock.
- Use the price list and find the value of each letter in the alphabet.
- Use a geo-board to construct a figure.
- Use a die to determine the number of sides of a figure. Students who roll a 1 or 2 must roll again. Ten points are awarded for each angle or line the student can list about their figure.
- Instruction is differentiated according to learner needs. The goal is to help all learners meet the intent of the specified learning goal.
    1. For students struggling to identify angles, provide additional pictures of real-life objects with the angles highlighted or bolded in the picture. Have these students identify the type of angle and then show the students a similar object in the classroom. Have each student run a hand along the angle in the picture and then along the angle of the real object.
    2. Other accommodations would be grouping so the student has a "buddy" within the larger group.
    3. Describe/rehearse rules of conduct so the child can be successful.
    4. Allow each student his/her physical "space" within the group.
    5. Pre-teaching vocabulary is especially important for ELL students.

Family Connections

- Have a family scavenger hunt for angles. A prepared list of angles could be given each family member to check off as they find them.
- Look for angles in nature.
- Explore on-line angle activities together.

Additional Resources

Books

Sir Cumference and the Great Kingdom of Angleland: A Math Adventure, by Cindy Neuschander; ISBN-10: 157091169X

Angles (Let's Investigate), by Ted Evans; ISBN-10: 1854354663

Angles are Easy as Pie, by Robert Froman & Byron Barton; ISBN-10: 069000916X

Web sites

Rainforest Maths: http://www.rainforestmaths.com/

Lots of interactive games: http://www.woodlands-junior.kent.sch.uk/maths/shape.htm#Angles

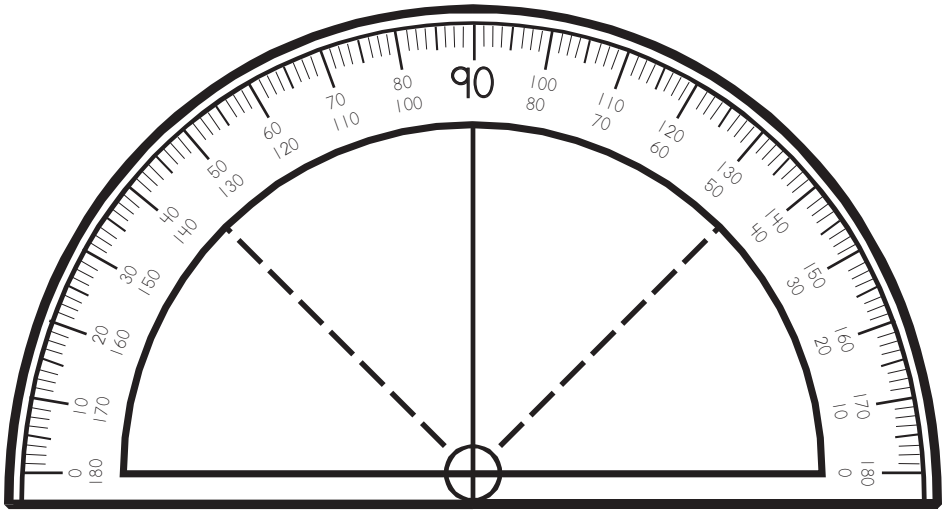
Introduction to Angles: http://www.quia.com/jg/65822.html

Protractor interactive: http://www.amblesideprimary.com/ambleweb/mentalmaths/protractor.html

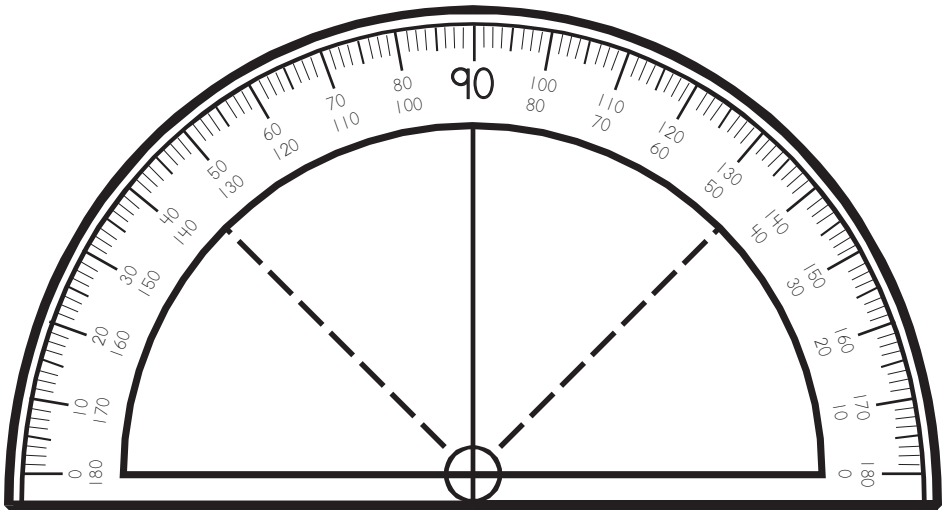
Mystery Word

R	C	R	A	P	T
R	O	T	O		

Label a Protractor



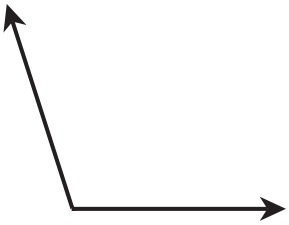
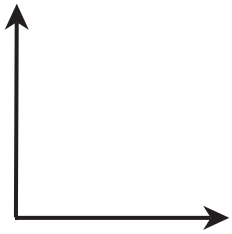
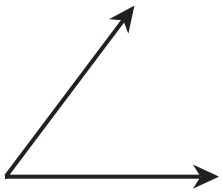
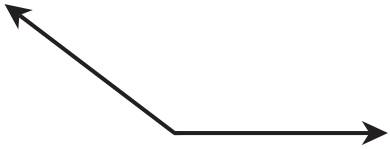
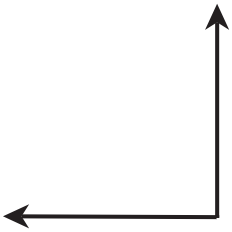
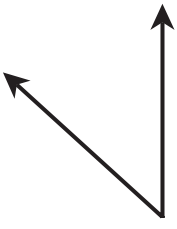
Making My Protractor



Name _____ Date _____

What's My Angle?

Identify the angle. Use a protractor to measure the angle and record.

1.  Angle _____ Degrees _____	2.  Angle _____ Degrees _____
3.  Angle _____ Degrees _____	4.  Angle _____ Degrees _____
5.  Angle _____ Degrees _____	6.  Angle _____ Degrees _____
7.  Angle _____ Degrees _____	8.  Angle _____ Degrees _____

What is My Name Worth?

Angle Letters

Use these letters to find the angles in your name.

A B C D E F G

H I J K L M N

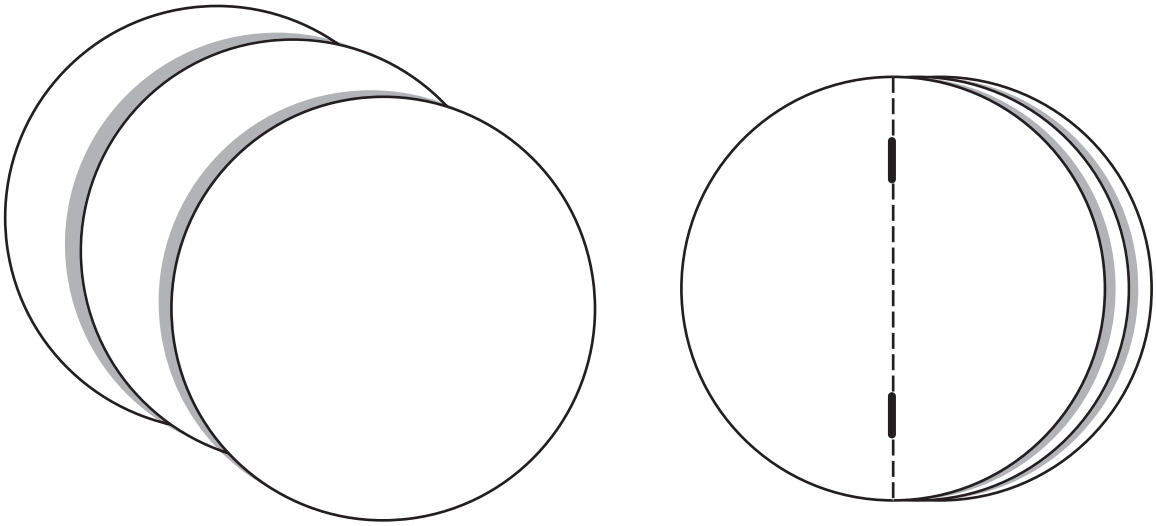
O P Q R S T U

V W X Y Z

$$$ ANGLE CASH $$$		
Acute angle	=	10 cents each
Obtuse angle	=	8 cents each
Right angle	=	5 cents each
Vertical line	=	3 cents each
Horizontal line	=	2 cents each
Diagonal line	=	1 cent each

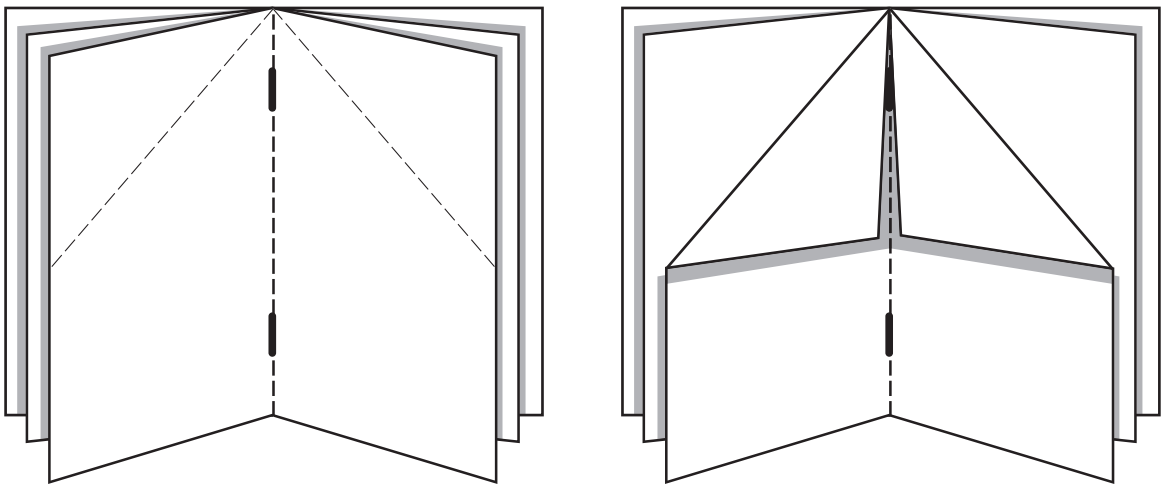
Circle Book in Journal

1. Cut same size circles and stack.
2. Fold the stack in half.
3. Staple in the middle to create journal page.
4. Create small reference book with mathematical vocabulary for topic.



Rectangle Book in Journal

1. Cut same size rectangles and stack.
2. Fold stack in half.
3. Staple in the middle to create journal page.
4. Create small reference book with mathematical vocabulary for topic.



Mountain Man Measurement Rendezvous

Math Standard IV

Objective 1

Connections

Standard IV:

Students will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.

Objective 1:

Describe relationships among units of measure for length, capacity and weight, and determine measurements of angles using appropriate tools.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
5. Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.

Content Connections:

Social Studies I-2; Utah history

Background Information

The Mountain Man played an important part in the history of the American frontier. The era of the Mountain Man/Trapper lasted about 40 years from 1820 - 1840. They made many contributions to history by exploring the entire western part of the United States. They discovered easier ways to get through the mountains, made maps, kept journals, and served as guides and scouts for pioneers, the army, and the government.

The Mountain Man also introduced the Rendezvous to the history books. Rendezvous were gatherings held each summer where mountain men would meet with fur traders to trade their furs for supplies. The trappers would trade their furs for the "possibles" needed for the coming fur season. "Possibles" were such things as Galena lead for rifle balls, black powder, traps, "rendezvous whisky," coffee, sugar, pemmican, jerky, clothing, blankets, horses and mules and other items that allowed them to live through the coming winter.

The life of a trapper was tough, lonely, and dangerous. The rendezvous gave these mountain men an opportunity to come together to swap stories of the year behind them; test their skills against each other, brawl, drink, and resupply for the coming year.

What kind of measurement would a mountain man have used? It was unlikely that they carried the common measurement tools of the time. In most cases, they did not need precise measurements in their daily activities. They generally used the measurement "tools" that mankind has over time to measure, parts of the human body. For example, the length of the tip of the index finger to the joint is a

"digit" and the width of four fingers is a "palm." The distance from the tip of the thumb to the end of the little finger is a "span." The width of the thumb is about an inch. The distance from the elbow to the tip of the middle finger is called a "cubit." Distance was measured by the length of a person's foot. Three feet equaled about a yard. Longer distances were measured in paces. Two steps is a "pace." These were good enough for their daily activities.

At the time of the mountain men, there were other areas of life and commerce that required more precise measurement. It is likely that at the rendezvous, where commodities were being traded, such as lead for bullets, bottles of whiskey, salt, flour and other commodities, standardized measurements, such as pounds and quarts were no doubt used.

In different times and places in the world, there have been many systems of measurement. Today we use only two systems, the customary system in the United States and the metric system, which is, used almost everywhere else in the world. In all cases, measurement systems are tools that are used to help achieve specific objectives. How precise they are is entirely dependent on how precise they must be to achieve these objectives. The measurement systems necessary for the day-to-day life of the mountain men illustrate these differing needs.

Research Basis

Boulton-Lewis, G. M., Wilss, L. A., & Mutch, S. L. (1996). An analysis of young children's strategies and use of devices of length measurement. Journal of Mathematical Behavior, 15, 329-347

Measurement is one of the principal real-world applications of mathematics. It bridges two critical realms of mathematics: geometry or spatial relations and real numbers. Done well, education in measurement can connect these two realms, each providing conceptual support to the other. Indications are, however, that this potential is usually not realized. U.S. students study geometric measurement less than those in most other countries (National Center for Education Statistics, 1996).

Bonwell, C. C. & Eison, J. A., (1991). Active Learning: Creating Excitement in the Classroom, ASHE-ERIC Higher Education Report No. 1. Washington, D.C.: The George Washington University.

Active learning is simply that—having students engage in some activity that forces them to think about and comment on the information presented. Students won't simply be listening, but will be developing skills in handling concepts in our disciplines. They will analyze, synthesize, and evaluate information in discussion with other students, through asking questions, or through writing.

Invitation to Learn

Invite students to make a list in their journals all of the ways they use measurement in a day. After completing the list, instruct them to mark five items they would not like to live without. Discuss how prevalent "measurement" is in our lives and how almost everything we do involves measurement in some way.

Instructional Procedures

Mountain Man Measurement Rendezvous

The Mountain Man Measurement Rendezvous is a hands on, active learning measurement activity designed to give children the opportunity to demonstrate their measurement skills in a classroom version of a measurement Rendezvous. This activity would be good to have outside. A classroom, gym or hallway could be used if they are available

Students will participate in several classroom Mountain Man Measurement Rendezvous activities where they will apply measurement skills. (The teacher may need to limit the number of the events that can be reasonably completed on the time allotted for this activity.)

1. Lead class in discussion about a Mountain Men Rendezvous. Make connections to Utah History.
2. Explain that students are going to use their measurement skills to see how well they will do in a classroom version of a measurement rendezvous.
3. Give each student a copy of Rendezvous Recording Sheet.
4. Students should refer to the recording sheets while teacher describes procedures and materials for each event.
5. Divide class into pairs or small groups. Set up rules for changing stations so that all groups have enough time to complete each task.
6. Remind students that they will usually get only one try in each event, and they need to record this attempt.
7. Laminate student directions and post them at each station. Each student or pair of students should keep track of their work on *Rendezvous Recording Sheet*.

Materials

- ❑ Pompoms
- ❑ Paper plates
- ❑ Craft sticks
- ❑ Straws
- ❑ Marshmallows
- ❑ Sponge
- ❑ mL measuring container
- ❑ Container for water
- ❑ Bowl
- ❑ Cans
- ❑ Beans
- ❑ Balance
- ❑ Marbles
- ❑ Metric weights
- ❑ Meter and yard sticks
- ❑ Measuring tape
- ❑ Measuring wheel
- ❑ Graph paper
- ❑ Pencil
- ❑ *Rendezvous Event Directions*
- ❑ *Rendezvous Recording Sheet*

Assessment Suggestions

- The teacher will assess the students' understanding of various measurements through observation during the events. The teacher will assess the student's estimation ability and the understanding of different measurements by checking the recording sheet for accuracy.

Curriculum Extensions/Adaptations/ Integration

- Mountain Man Measurement Rendezvous activity could be done using only metric or standard measurement.
- Invite students to make up their own measurement activities and game.

Family Connections

- Students and families can create measurement activities around a different theme, such as a carnival, sports, winter or summer events.
- Bath time provides good opportunity to practice measuring capacity.

Additional Resources

Books

How Tall, How Short, How Far Away, by David A. Adler; ISBN-10 0823416321

Measuring Penny, by Loreen Leedy; ISBN-10 0805065725

It's Probably Penny, by Loreen Leedy; ISBN-10 0805073892

Twelve Snails to One Lizard, by Susan Hightower; ISBN-10 0689804520

Web sites

Rainforest maths (excellent site)- http://www.rainforestmaths.com/

Measurement http://www.teachingmeasures.co.uk/menu.html

Multiple sites: http://www.saskschools.ca/curr_content/byersjmath/geometry/students/coverpg.html

Rendezvous Event Directions

Post these directions at each station.

Jump The Creek

Materials

- Meter Stick

1. With feet on the starting line, long jump as far as possible.
2. Using a meter stick, measure the distance from the starting line to the closest place to the starting line that your body touched.
3. Record.

Grab The Gold

Materials

- Balance scale
- Metric weights
- 2 cups marbles or other similar objects

1. The students will take turns reaching into a container and grabbing as many marbles/objects as possible.
2. The objects grabbed should then be placed on the balance scale. The student should estimate (in grams) how heavy the objects are.
3. The student should then place the gram weights on the other side of the scale until it balances. Record weight.

Wash Day!

Materials

- Large kitchen sponge
- Container with water
- Large bowl
- mL container

1. The student will soak the sponge in a container of water. Wait for it to soak up lots of water.
2. Using only one hand, remove the sponge and hold it over the large bowl. Squeeze the sponge over the empty container.
3. The student will then estimate in mL the amount of water in the second container. Pour the amount in to the measuring container, and then measure in mL and record.

Buffalo Chip Throw

Materials

- Paper plates
- Measuring wheel/measuring tape
- Buffalo chips (paper plates)

1. Student stands at designated line and throws a "buffalo chip" as far as he/she can.
2. Partner uses measuring wheel to measure distance from starting line to where plate landed.
3. Record on recording sheet. Partners reverse places.

I Need New Buckskins!

Materials

- Standard measuring tape or yard stick

1. Measure parts of your body using a string, yarn or measuring tape. If using string, measure body part and then measure string (inches, feet or yards).
2. Record on recording sheet.
3. Measure width of your arm span, wrist to longest finger, length from your waist to floor and circumference of your head!

Stone Throw

Materials

- Measurement wheel or long tape measure
- 6 medium/large pompoms (assorted colors)

1. Student stands at designated line and predicts how far she thinks she can throw the "ball." Record.
2. Throw "ball" and measure actual distance. Leave colored pom-pom where it landed. After all team members have thrown, compare who threw it the shortest or farthest distance.
3. Students work in teams of two. One person throws and the other measures. Reverse roles and record on the recording sheet.

Arrow Challenge

Materials

- Craft stick (previously decorated)
- Measurement wheel or long tape measure.

1. Student stands at a designated line and predicts how many feet/yards he/she can throw the "arrow."
2. Throw the "arrow" overhand. Partner measures actual distance. Students work in teams of two. One person throws and the other measures.
3. Reverse roles and record on recording sheet.
4. Measure with the measurement wheel.

Big Foot Bragging Rights

Materials

- 8 ½ x 11 graph paper/centimeters
- Pencil

1. Student predicts how many square centimeters he thinks his foot is. (This can be done with shoe off or on.) Record.
2. Student places his foot/shoe on the sheet of centimeter paper while partner draws around his foot/shoe.
3. Count number of square centimeters that are inside of the drawing.
4. Record area of foot on recording sheet.

Cache It Or Carry It

Materials

- 5 pounds dried beans
- Three cans, different sizes

1. Students estimate how many beans it will take to fill the largest cooking pot. Record.
2. Scoop beans, cup at the time, emptying it into the "cooking pot". Record actual amount.
3. Next, estimate how many beans will fill the smaller "pot". Record.
4. Repeat scooping and fill the smaller container. Record.

Straight Shooter

Materials:

- Boba Straw
- Mini-Marshmallows
- Measuring tape/measurement wheel

1. Student stands at designated starting line.
2. Squish marshmallow and insert into straw.
3. Shoot the marshmallow by puffing a strong burst of air into the straw.
4. Record on recording sheet.

Name _____ Date _____

Rendezvous Recording Sheet

	My Prediction	Actual Measure
1. Buffalo Chip Throw (measure in Standard)		
2. Grab the Gold (measure in Grams)		
3. Jump the Creek (measure in Standard)		
4. Wash Day! (measure in metric)		
5. Stone Throw (measure in metric)		
6. Arrow Challenge (measure in metric)		
7. Big Foot (measure area in centimeters)		
8. Cache it or carry it! (measure in standard)		
9. I Need New Buckskins! (measure in standard)		
Width of arm span		
Wrist to longest finger		
Circumference of head		
Leg length—waist to floor		
10. Straight Shooting (measure in standard)		

Science I-2

Activities

Water Cycle

Dino Drool

Standard I:

Students will understand that water changes state as it moves through the water cycle.

Objective 2:

Describe the water cycle.

Intended Learning Outcomes:

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

Content Connections:

Math V-1; Collect, organize and display data

Science Standard I

Objective 2

Connections

Background Information

Earth's water system is finite; the same water we are drinking today has been cycled over, on, and under Earth's surface for thousands of years. This continual movement of water, the water cycle, collects, purifies and distributes the water we need to live. Because water does move in a never-ending cycle, the water we are using today is the same water prehistoric creatures used for sustenance. The model in this activity illustrates the water cycle on a global level. The total amount of water inside the model is constant, like the total amount of water on Earth is constant.

The model is constructed using three clear two-liter bottles with caps. These bottles will need to be prepared beforehand by removing labels and cutting one bottle just below the curved top, (you can use a drywall screw to make a starter hole for the scissors). Label this bottle "A" with a permanent marker on the side of the bottle. Cut the other bottle just above the curved bottom; label this bottle "B" with a permanent marker on the side of the bottle. Label the third bottle "C." A quarter inch hole should be drilled in one of the bottle lids.

This activity will require a minimum of two 50-60 minute periods.

Research Basis

Ash, D., & Kluger, B. B., (1999). Identifying Inquiry in the K-5 Classroom.

Instructional models engage students in scientific questions, provide opportunities for students to explore those questions, and require students to interpret data to create explanations. Good science inquiry involves learning through direct interaction with materials and phenomena. One important sign of inquiry is the relative level of

control that the students have in determining various aspects of the learning experience.

Marzano, R. J., Pickering, D. J., Pollock, J. E., (2001) *Classroom Instruction That Works: Research-based Strategies for Increasing Student Achievement.* Alexandria, VA: ASCD.

Scientific thinking is enhanced through instructional methods such as identifying similarities and differences; summarizing and note taking; non-linguistic representation; cooperative learning; setting objectives and providing feedback; generating and testing hypotheses; and questions, cues, and advance organizers.

Invitation to Learn

The teacher invites the class to have a drink of water. As the class is sipping their cups of water, the teacher asks 5 students to each open a numbered envelope and read the contents. Each envelope contains a factoid about the water cycle that has previously been discussed in class. The fifth envelope is opened and the student reads aloud from the card, "Mr./Mrs./Ms._____, do you know you are drinking dinosaur drool?" The teacher either pretends to choke or spits out the water in a "dramatic" fashion. "How is this possible?" exclaims the teacher, "It tastes like clean, fresh water, it looks like clean fresh water, it smells like clean fresh water, how did the dino drool get in here? It is time for an investigation!"

Materials

- ❑ *Building a Water Cycle Model*
- ❑ *Fill the Water Cycle Model*
- ❑ *The Water Cycle Process*
- ❑ 2-liter bottles
- ❑ Scissors
- ❑ Transparent tape
- ❑ Cotton strips
- ❑ Potting soil
- ❑ Grass seed
- ❑ Measuring cup
- ❑ Hand shovel
- ❑ Ruler (cm)

Instructional Procedures

1. Introduce this activity of building a water cycle model to the students with a review of evaporation, condensation, and precipitation. Introduce the terms transpiration and percolation and discuss their meanings.
2. Divide the class into groups of 4. Each group will work together to make one model.
3. Give each group a copy of *Building a Water Cycle Model* instruction sheet and instruct the students to follow the written directions.
4. When each team has completed assembling their model, give them a copy of *Fill the Water Cycle Model* instruction sheet.
5. At the conclusion of each team filling their model, give them the *The Water Cycle Process* label handout. Have each team tape the labels to the model where they think each part of the water cycle is being represented in the model. Then have each

student draw the model in their science journals and label the parts in their journal. Check for accuracy.

6. Have each individual student write a prediction in their journal about what will happen in their team's model. Ask them: What is their hypothesis about the grass seed? The water? What are they observing in this model that they can relate back to the water cycle on a global level? What purpose does the soil have in the water cycle? Water is stored as it passes through the water cycle. What bodies of water does the collector in bottle "B" represent?
7. Instruct students to observe their model on a daily basis for two weeks and record their observations in their journal. Divide two journal pages into six sections with the headings, *evaporation, condensation, precipitation, collection, percolation,* and *transpiration*. Encourage the students to record their observations specific to the components of the water cycle. Ask them to articulate what is happening at each stage in their model. To accommodate all students, observations can be written, expressed verbally to the teacher or drawn in their journal.
8. Ask students if they understand why we are drinking dino drool!

Assessment Suggestions

- Photograph interview. Take photos of the students building their models and the models "in progress." After the activity is completed (a week later) show the students the pictures and ask questions. You can do this as a group or individual interviews. As students observe the pictures, some questions that can be asked are:
  - What were you doing when this picture was taken?
  - What did you learn?
  - What more have you learned about the topic since the day of this picture?
  - How did you use what you learned?
  - What is happening in this picture as it relates to the water cycle?

Depending on the students and the experience being assessed some questions may be more pertinent than others. The teacher can create the questions that are the most important to measure student understanding. This type of assessment benefits students who may

struggle with writing or expressing themselves with the written word. An oral assessment allows them to demonstrate science vocabulary and concepts without getting mired in the process of writing. This type of assessment can make science learning visible by having students recall facts, concepts, applications and actions. A rubric can be created to measure the completeness of the students' answers.

- Team Evaluation – Ask each team member to evaluate their participation in the model building process and what they learned. (See *Team Evaluation* sheet.)
- Use the *Water Cycle Assessment Test* sheet to measure student understanding at different levels. The teacher can determine how many points constitute a letter grade. (See *Water Cycle Assessment* sheet)

Curriculum Extensions/Adaptations/ Integration

- To illustrate the effects of pollution on ground water add 10-15 drops of blue food coloring onto the growing grass seed. Wet each "lawn" thoroughly using the water bottle. This is to simulate rainfall. Within a minute or so, the food coloring should begin to circulate downward into the groundwater (Bottle A). Discuss with the students what dangers chemicals may pose to our water supply.
- Ask students to remove one of the components of the water cycle, i.e. light (energy source) or the water in bottle "A". Ask them to write a hypothesis about what they think will happen inside their model. Observe the model over the next week, recording observations. At the conclusion of the week have students compare their hypothesis to what they observed.
- Visual Arts – Utah State University International Office for Water Science Education sponsors a contest for elementary school students. Students from all over the state are invited to send in pictures depicting their interpretation of how they can conserve and protect our water supply. The winning entries are developed into a calendar. Each year has a different theme. The 2007-08 calendar's theme was Water and Me. This is a beneficial opportunity for students to share their water knowledge in a non-linguistic representation. For more information contact the USU Water and Science Education office. (See site address under *Web Sites*)

- Math – Have the student teams create a graph for a two-week period and measure the water that collects in bottle "B". The measurement can be in millimeters, centimeters or inches. They can empty the collector every other day so there is a baseline for each measurement. Have students take away the energy source (light) and see if the amount of precipitation is affected.
- Dramatic Arts – Students can design puppets, create characters, or use other props to act out the water cycle process.

Family Connections

- Let students take their model home and give a lesson to their parents and family. Have students include how important it is to conserve and save water. Have the students report back to class on their experience.
- "Deputize" your students and have them be "Water Waster Watcher" police officers at home. Provide "tickets" to hand out to family members who are "caught" using water unwisely.

Materials

- ❑ You Have Been Deputized letter
- ❑ Water conservation packet
- ❑ *Tickets*

Additional Resources

Books

The Water Cycle, by Trudi Strain Trueit; ISBN 0-531-16220-6

The Snowflake-A Water Cycle Story, by Neil Waldman; ISBN 0-7613-2347-3

A Drop of Water – A Book of Science and Wonder, by Walter Wick; ISBN 0-590-02319-5

A Drop Around the World, Barbara Shaw McKinney; ISBN 1-883220-72-6

A Teacher's Guide to A Drop Around the World, by Bruce and Carol Malnor; ISBN 1-883220-77-7

The Life and Times of a Drop of Water, by Raintree Press; ISBN 1-4109-1956-0

The Magic School Bus – Wet All Over, by Joanna Cole, Scholastic Inc; ISBN 0-590-50833-4

Web sites

http://www.uen.org/k12educator/

UEN has a link titled ***emedia***. The videos and clips on this sight can be downloaded, burned and used in your classroom. There are hundreds of 4th grade friendly science videos. Below are some that relate to the water cycle. Instructions to access the site: Click on ***emedia,*** click on ***Access emedia***, type in ***water cycle*** in the quick search

- *The Importance of Water* – Students learn that water is essential to life and discover many places that water can be found on Earth.
- *The Water Cycle* – Explains the water cycle as a whole as well as each part in detail.

- *NASA. SCI Files* – The Case of the Wacky Water Cycle.
- *The Magic School Bus, Wet All Over* – In the TV show "WET ALL OVER," Arnold and Wanda are due to give a report on the town waterworks. But Ms. Frizzle thinks it's field DRIP time! She turns the bus and class into water drops and the kids evaporate, condense, become rain and rush by river into the ocean. After several trips through the water cycle, they're ready to turn back into regular kids. But the magic key that will get them out of the cycle is locked in the school bathroom! Trying to work their watery way into the bathroom, the kids go through the town waterworks and see how water is purified. Can they get to school through bathroom pipes? Or are they stuck in the water cycle forever?

http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html

This website is an animated version of the water cycle.

http://pbskids.org/zoom/activities/sci/

A gold mine of fun science experiments that lets you explore the different properties of water. Click on the water link.

http://iowse.usu.edu

This links you to the Utah State University International Office for Water and Science Education, education page. You can also access information about the coloring contest mentioned in the extensions section.

Organizations

National Science Teacher Association, http://www.nsta.org/

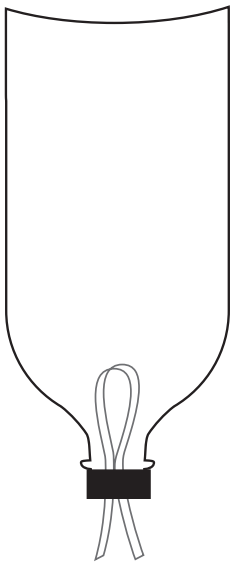
The National Science Teachers Association (NSTA), founded in 1944 and headquartered in Arlington, Virginia, is the largest organization in the world committed to promoting excellence and innovation in science teaching and learning for all. This organization is an excellent resource for seasoned and new teachers.

Building a Water Cycle Model

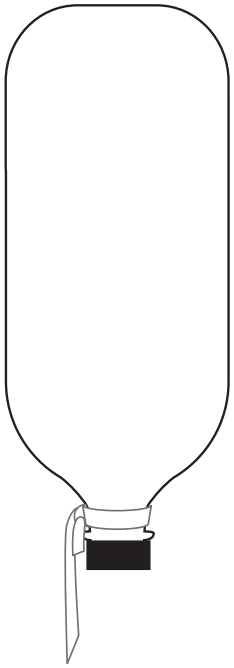
Team_____

1. Place the predrilled cap on Bottle "B". Insert a 30 cm (12") looped strip of a cotton shirt or rag through the hole so it hangs about 10 cm (4") down from the cap.
2. Tie the other 30 cm (12") cotton strip around the neck of bottle "C." Trim the piece of cloth so it hangs 5 cm (2") from the bottle opening. The piece of cloth hanging down should be trimmed like a necktie, its end cut to a point. Put a cap on bottle "C." The other cap will be used as a water collector in the model.
3. Assemble the model. Bottle "A" is the base of the model, with bottle "B" fitting "spout" first into bottle "A." Bottle "C" fits "spout first" into bottle "B." Once you know everything fits, it is time to fill the model, so you will be taking it apart.

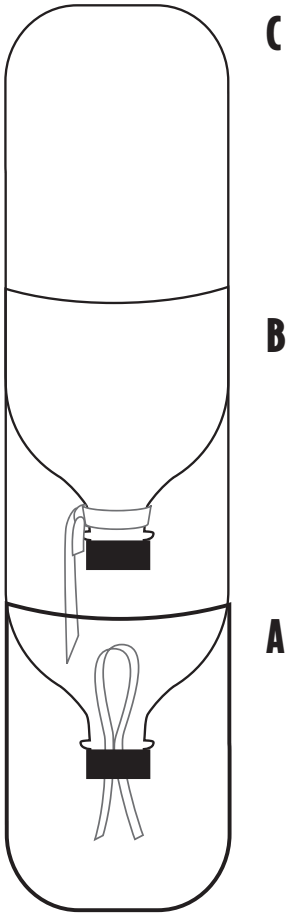
Bottle B



Bottle C

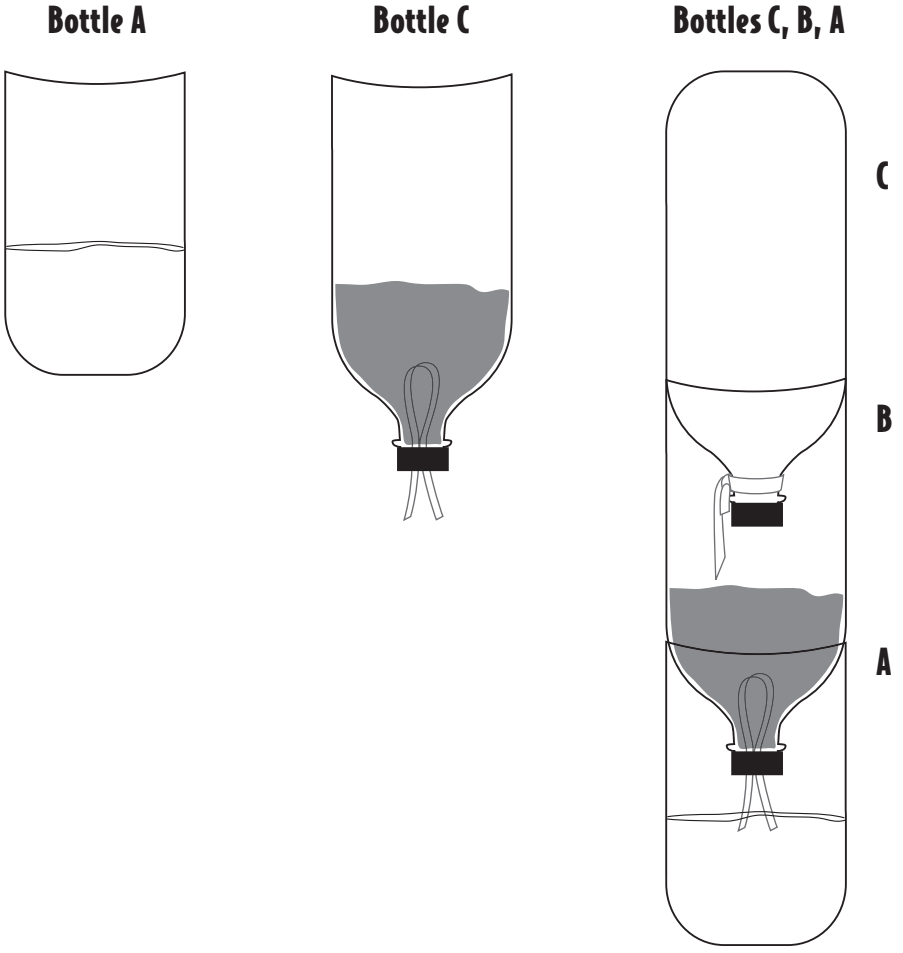


Bottles C, B, A

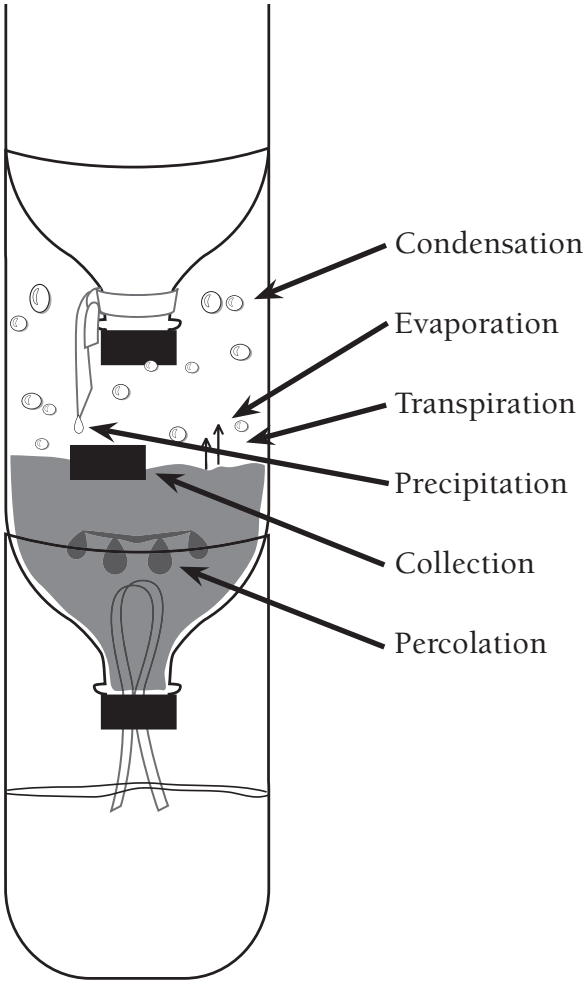


Fill the Water Cycle Model

1. Generously wet both strips of cloth. The moistness allows the water to travel along the cloth. This is called capillary action, which is the natural upward movement of water in confined areas, like the spaces between soil particles.
2. Add 250 ml (1 C) of water to bottle "A". This water will be the source of water for the cycle in the model.
3. Fill bottle "B" with a generous cup of pre-moistened potting soil. The soil should cover the loop of cloth.
4. Sprinkle a bottle cap of grass seed into the soil in bottle "B."
5. Take the remaining bottle cap and press it into the soil in bottle "B." This acts as a collection receptacle for water.
6. The cloth strip on bottle "C" should be adjusted so it hangs over the "pond" in bottle "B." this allows the water to collect in the cap.
7. Fill bottle "C" with 200 ml (2/3 C) of water and tightly close the lid. Do not put more water in Bottle "C" than directed. The weight of too much water can make the model top heavy and at risk of toppling over. Assemble the model and put it near a light source.



The Water Cycle Process



Write the six water cycle processes on the small labels below and attach them in their appropriate locations on the model. Use the above drawing as a guide.

Evaporation: Water traveling upward as vapor (gas).
Condensation: Water vapor turning back into a liquid.
Precipitation: Water falling from the sky as snow, rain, sleet, or hail.
Collection: Water collecting in puddles, ponds, rivers, oceans, glaciers, etc.
Percolation: Water mixing with soil.
Transpiration: Water evaporating from the leaves of plants.

Name _____ Date _____

Team Evaluation

1. Explain at least two specific ways that your team worked well during this activity.

2. Explain one specific way you would like to see your team improve for future activities.

3. State one specific way you contributed to your team in a positive way during this activity.

4. Describe in detail, what you learned about the water cycle and how the earth has a finite amount of water to fill the needs of everyone and everything on our planet.

The Water Cycle Assessment Test

Complete ____ points in answers on a separate sheet of paper. Place a checkmark by the choices that you complete. Due_____

Knowledge (5 points each)

_____ Define the terms percolation, transpiration, and energy. Tell where the water cycle gets its energy.

_____ Define the term water cycle. Explain the meanings for each of the six major processes that take place in the water cycle.

Comprehension (10 points)

_____ Write a paragraph that explains how the water cycle works on earth. Use all six water cycle terms in your response.

Application (15 points)

_____ Write a paragraph that explains how the water cycle works in your front yard.

Analysis (20 points)

_____ Brainstorm a list of 10 ways your family uses water and 10 ways your family can reduce water use to encourage water conservation. Write a contract for your family that will put three of these ideas into practice. Report back to the class after 3 weeks to let them know how your contract worked.

Synthesis (25 points)

_____ Create a song, poem, or rap that illustrates the water cycle. A 25 point response will use the following words in a meaningful way; evaporation, condensation, precipitation, collection, percolation, and transpiration. Be prepared to share your artistic rendition with the class.

Evaluation (30 points)

_____ Respond to this statement; "If we are not careful, one day Earth will run out of water." Write a 100+ word response that uses research to support your informed opinion. Include your rough draft with your final copy and a bibliography of your research.

Family Water Conservation Checklist

YOU HAVE BEEN DEPUTIZED! IT IS YOUR DUTY TO ORDER ALL WATER WASTERS TO CEASE AND DESIST THEIR WASTEFUL WAYS!! You have the power to ticket any and all family members who you find wasting water. Discuss with your family ways you can save and conserve water.

Bathrooms	Suggestions
1. Have toilet tanks been checked for leaks? ❑ Yes ❑ No	Place a few drops of blue food coloring in the toilet tank. If you can see the color in the toilet bowl without flushing, a wasteful leak needs to be repaired.
2. Is the toilet being used as a wastebasket? ❑ Yes ❑ No	Extra toilet flushes can waste up to 7 gallons of water with each flush.
3. Do you turn the water off while brushing your teeth? ❑ Yes ❑ No	Before you begin brushing, wet your brush and fill a glass for rinsing.
Kitchen/Laundry	**Suggestions**
1. Are dishwashers and washing machines used only for full loads? ❑ Yes ❑ No	When you run full loads in your appliances you save water and energy, and your machines will last longer.
2. Is water left running for rinsing produce or dishes? ❑ Yes ❑ No	Keep the water in the sink with a stopper, a great conservation idea!
3. Have your faucets been checked for leaks? ❑ Yes ❑ No	Repair leaks as soon as possible. One drip per second wastes more than 2,400 gallons of water per year.

Outdoor Use	Suggestions
1. Are lawns and shrubs watered only when it's really needed? ❑ Yes ❑ No	Check your lawn before watering. A lawn that springs back after being stepped on doesn't need water. Most shrubs need only one monthly deep watering during the summer.
2. Is your lawn watered before 10 a.m. or after 5 p.m.? ❑ Yes ❑ No	Water only during the cooler parts of the day. The sun can cause most of the water to evaporate before it is absorbed into the soil.
3. Are your walkways or driveways swept for cleaning? ❑ Yes ❑ No	Sweep your driveway and walkways instead of using a hose to clean them off.
4. Is water left running while washing your car or RV? ❑ Yes ❑ No	Fill a bucket with soapy water and wet down your vehicle. Turn off the hose and wash your car with the soapy water from the bucket. Rinse with the hose. A hose left running can waste up to 10 gallons of water per minute.

Water Waster Violation

Uh Oh! You are being cited for wasting water!

Date: _____

Name: _____

Infraction:	Ways to fix the problem:

Water Waster Watcher Deputy: _____

Round and Round

Science Standard I

Objective 2

Connections

Standard I:

Students will understand that water changes state as it moves through the water cycle.

Objective 2:

Describe the water cycle.

Intended Learning Outcomes:

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

Content Connections:

Language Arts VIII-6; Write in different forms and genres

Background Information

Water is such a basic life sustenance that it is easy to take for granted. Water is a substance that can naturally occur in three different forms, solid, liquid, and gas. The solid form of water can be found in the glaciers and ice caps on the opposite poles of Earth. We are most familiar with water in its liquid form. We see it in our lakes, rivers, streams, and oceans. Water vapor rises into the atmosphere and condenses back into a liquid through clouds, fog, and mist. The water then falls to Earth in the form of rain, hail, sleet, and snow to nourish our planet and sustain life.

Much of Earth's water is in constant motion, and the water cycle describes the continuous movement of water on, above, and below the surface of Earth. The water cycle is truly a "cycle," with no beginning or end. The vocabulary words, *evaporation, condensation,* and *precipitation* describe the continuous movement of water into the air and ground, onto and over land and back.

This activity will take 2-4 class periods, depending on how involved the students are in creating the final product.

Research Basis

Harlen, W. (2001). *Primary Science…taking the plunge; How to teach primary science more effectively for ages 5 to 12.* Portsmouth, NH: Heinemann.

An increase in student learning occurs when students have opportunities to discuss what they have observed and inferred in small groups and as a class. Elementary students' science learning needs to be scaffolded around a metacognative approach, where students are

asked to think about what they know (what they can directly observe) and what they do not directly know (what they need to infer).

Kluger, B. B., (1999). *Inquiry thoughts, views, and strategies for the K-5 classroom.* National Science Foundation, Arlington, VA.

In inquiry-based classrooms, teachers support students as active learners as they explore, carefully observe, plan and carry out investigations, communicate through varied methods, propose explanations and solutions, propose thoughtful questions, and critique their science practices. Good science inquiry provides many entry points—ways in which students can approach a new topic—and a wide variety of activities during student work.

Invitation to Learn

With a permanent marker write Evaporation, Condensation, and Precipitation around the perimeter of a Frisbee®. Write WATER CYCLE in the center of the disc. Have students stand in a circle. Toss the Frisbee® to a student. Have the student recite the steps of the water cycle from where their hand caught the disc. For example, if the disc is caught on the word "Evaporation," the student will tell what happens when water evaporates and relate the next steps in the cycle after evaporation, which are condensation and precipitation. This can be repeated as often as desired. For the second round, play the song "Water Cycle Boogie" and toss the disc around the circle. When a student catches the disc on a water cycle "step" they will act out the word. For example, if the disc is caught on "precipitation," the student will indicate a downward motion. If it is caught on "evaporation," the student will indicate an "up" motion. To add to their movement have the students go "round and round" in the circle as they toss the Frisbee® back and forth to each other.

Materials

- ❑ Frisbee®
- ❑ Black marker
- ❑ *Singing in Our Garden*
- ❑ Chart paper
- ❑ Watercolors
- ❑ Crayons
- ❑ Paper

Instructional Procedures

1. Divide the class into 4-5 groups. Provide each group with review resources about the water cycle. (See the booklist from the Dino Drool activity) There is a student reference guide at http://www.schools.utah.gov/curr/science/core/4th/TRB4/default.htm that can be downloaded and distributed to students.
2. On an easel sized Post-it®, have students write down the information they think is important to know for someone who is just learning about the water cycle. Tell them they are becoming authors of their own water cycle book. Play the

"Water Cycle Boogie" as they work. Instruct the groups to use the song's organization to help them create their story.

3. Once the students have determined how they want their facts to be represented, give each group another easel sheet and have them create a rough draft "storyboard", complete with text and illustrations.
4. The final draft can be on any type of paper. Markers, colored pencils, crayons, and watercolors can be used to create color and interest in the illustrations. The students can choose to make a book, a final storyboard, a DVD, or a mural.
5. Have students share their final product and teach the water cycle to a younger audience. If there is an opportunity for a school wide science fair or other school wide audience, have students share their product.

Assessment Suggestions

- Photograph interview – see Dino Drool activity.
- Card sorts – This type of assessment measures student attitude and knowledge toward science and what type of science student they are.

Print individual cards with the water cycle vocabulary and attitude descriptions. Allow students to group the cards according to the water cycle and have them match science attitude cards to their science knowledge. Attitude cards such as, "Thinks up good questions" or "Thinks up own ideas to study" are paired with knowledge cards such as " Precipitation is_____". (Student fills in the blank.) You can use this assessment at the beginning, middle and end of an activity to measure understanding.

Curriculum Extensions/Adaptations/ Integration

- Science - Cover a medium sized box with question marks. Put a container of water inside the box. Invite students to ask questions so they can determine what is inside. Instruct students to ask three types of questions:
  - Does it _____? / Can it _____? (verbs)
  - Is it_____/ (adjectives)
  - Does it have_____? (nouns)

They may want to ask specific questions like, "Is it a leaf?" or "Is it a spider?" right off the bat. The purpose of asking the above questions is to help the students gather information so they can make an educated inference about what is in the mystery box, not a lucky guess.

A student/teacher exchange might go like this:

Student: "Can it move?"

Teacher: "Yes, it can move?"

Student: "Does it have six or more legs?"

Teacher: "No, it does not have six or more legs?"

Student: "Does it have four legs?"

Teacher: "No, it doesn't have four legs."

Student: "Does it have legs?"

Teacher: "No, it does not have legs."

Student; "Is it a snake?"

Teacher: "No, it is not a snake."

This exchange may give you an idea of how to answer and guide the inquiry. You can introduce the properties of water through this type of question/answer activity. Just because it moves, does not mean it is an animal! Water also conducts electricity, but it is not metal!

As the teacher and student exchange information, write down the responses on three pieces of chart paper with the headings, verbs, adjectives, and nouns. Stop the questioning when you feel he students can make an educated inference about the mystery box's content. Ask them to write or draw what they think the mystery object is using this lead, "I think/infer that the mystery object is _____. You can also ask, "Are you 100% certain?" Point out that the questioning process is vital to science understanding and discovery.

At the end of the questioning, the container of water is revealed. Make the list of nouns, verbs, and adjectives available to help the class continue their inquiry into water and to journal their science experience.

- Divide students into four groups to participate in four stations. Students will record their observations, draw pictures, and make inferences about each step in the water cycle in their journals.

  Evaporation Station

  Condensation Station

  Precipitation Station

  Water Cycle Station

- Read the book *Water Dance* by Thomas Locker. identify the nouns, verbs, and adjectives that describe each part of the water cycle from the book, under the word strips, evaporation, condensation, precipitation, and water cycle.
- Invite students to highlight and identify the words on the posters that best describe the water cycle according to what they have come to understand through their experiments and experience and highlight them on the posters.
- Ask students, "What have you learned?" Direct them to write a reflection about their learning over the past few days. Have them look at their predictions, their observations and their inferences about the water cycle in their journals. Instruct them that they will need to use the water cycle vocabulary in a meaningful way, using the parts of speech displayed and discussed in class to help the reader understand the water cycle and its importance to our planet.
- Language Arts/Visual Arts – Have students create their own "Water Dance " book using their reflection vocabulary and watercolors.
- Science /Social Studies – Have students do Internet research on different world biomes, rain forest. desert, wetland, etc and graph the different amounts of annual rainfall in these areas. Do the same for Utah counties and compare and contrast Utah's rainfall with other world biomes.

Family Connections

- Have students share their water cycle reflection with their family. Discuss other parts of speech that describe the water cycle to help create understanding of the water cycle process.
- Students can perform a "Water Cycle Boogie" for their family.
- Students can use their final product to teach their family about the water cycle.

Additional Resources

Books

Water Dance, by Thomas Locker; ISBN 0-15-216396-4

Where the River Begins, by Thomas Locker; ISBN 0-14-054595-6

The Earth Science Book – Activities for Kids, by Dinah Zike; ISBN 0-471-57166-0

Daily Warm-ups – Earth Science, by Walch Publishing; ISBN 0-8251-4454-X

Picture-Perfect Science Lessons, by Karen Rohrich Ansberry and Emily Morgan; ISBN 0-87355-243-1

More Picture-Perfect Science Lessons, by Karen Ansberry and Emily Morgan; ISBN 978-1-93353-112-0

Media

Singing in our Garden, CD, Banana Slug Band; ISBN 680598 00272 5

What's the Weather, Puppets - 6 hand puppets that facilitate this activity. Oriental Trading, Hands on Fun Catalog, Summer 2008 MV-58/1017, pg. 86.

Web sites

http://www.surfnetkids.com/watercycle.htm

This site links you to a number of "kid friendly" sites related to the water cycle.

http://www.schools.utah.gov/curr/science/core/4th/TRB4/default.htm

This is the USOE website for 4th grade science core curriculum.

Card Sorts

Define the water cycle.	**Describe the process of condensation.**
Name 4 types of precipitation.	**What is evaporation?**
What is the energy source of the water cycle?	**Use 3 adjectives to describe the water cycle.**

What would happen to the water cycle if the sun didn't shine?	**Where will evaporation happen faster on a sunny day, in the morning or afternoon?**
Use 3 nouns to describe the water cycle.	**Use 3 verbs to describe the water cycle.**
Where are some places in your home that you can observe condensation?	**I can think up good questions.**

I can think up my own ideas for study.	I can ask for more time to finish my experiments.
I can complete my work on time.	I can work together with my peers to find answers to our questions.
I can use different resources to answer my questions.	I can write and draw with care in my journal.

My reflections in my journal are important and meaningful.	

Evaporation Station

– Ask the question, "How does water get into the air?"

Materials:

Three small plastic plates
Three different colored markers
Water

Directions:
Make a shallow puddle of water on each plate. Trace each puddle with the same color marker to indicate the size of the puddles.

Number the plates and place them in three different areas: direct sun, complete dark, and in the middle of the classroom.

Write a prediction in your journal about what will happen on each plate.

Sun _____

Dark _____

Partly sunny (classroom) _____

Check the puddles after one hour and trace each puddle with the second color marker.

Describe, in your journal, how they puddles have changed.
Check the puddles the next day. Trace each puddle the third color marker.
Draw pictures of the plates in your journal using the 3 different colors to show what happened.

Answer these questions:

Which puddles shrank?
Why do you think the puddles shrank at different rates?
What do you think happened to the water?
What other questions do you think are important to ask about evaporation?

Condensation Station

- Ask the question, "How does condensation form?"

Materials:

Pint glass jar
Water
Ice cubes

Observe the jar as it rests at room temperature, without any water. Write your observations in your journal. How does the jar feel? What does it look like?

Fill the jar with ice and water. How does the jar feel on the outside? After a few minutes what does the jar look like?

Leave the jar full of ice water for about a half hour. Write your observations about what the jar looks like and feels like.

Explain how you think water appeared on the outside of the jar.

Precipitation Station

– Ask the question, "How is rain made?" (teacher directed)

Materials:

Quart glass jar with a lid
Ice cubes
Boiling water

Predict: What do you think will happen when ice cubes are put on top of the jar of hot water?

The teacher will add about one inch of boiling water to the jar. Place the lid upside down on the mouth of the jar to create a lip. Place three to four ice cubes in the lid.

Draw two pictures in your journal – One picture of the jar of hot water as soon as the ice is placed on the lid. And the other picture after 5 minutes have passed.

Write your observations at:

- 1 minute
- 2 minutes
- 3 minutes
- 4 minutes
- 5 minutes

Why do you think water formed at the top of the lid?
How do your observations compare with your prediction?

Water Cycle Station

- Ask the question, "How does the water cycle work? Does the water cycle need an energy source?"

Materials:

Song: *Water Cycle Boogie*

Watch and/or listen to the Water Cycle Boogie. Draw in your journal a visual representation of the water cycle.

Where would you have the cycle begin?

Could we have the water we need if one of the steps were eliminated?

Why is the sun important to the water cycle?

What do you think it means for the water cycle to go "round and round" and "up and down?"

Why is the water cycle important to life on Earth?

Math I-3&5

Activities

Add/Subtract Fractions

Focus on Fractions

Standard I:

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

Objective 3:

Model and illustrate meanings of multiplication and division of whole numbers and the addition and subtraction of fractions.

Intended Learning Outcomes:

1. Use models to add and subtract simple fractions where one single digit denominator is 1,2, or 3 times the other.

Content Connections:

Math I-5; Problem solving

Math Standard I

Objective 3

Connections

Background Information

This activity is meant to follow a thorough introduction to fractions. Students should be comfortable with the concept of what a fraction is, specifically 1/2, 1/3, 1/4, 1/5, 1/6, 1/8, 1/9, 1/10 & 1/12. Students should be able to describe and show concrete representations of each of these fractions.

Research Basis

Meagher, M., ERIC Digest, June 2002, "Teaching Fractions: New Methods, New Resources"

It doesn't matter if fractions are introduced as counting or as measurements. Teachers often fail to recognize or utilize prefractural knowledge. Preschoolers recognize what "1/2" is. We often take an adult centered approach rather than a child centered approach to teaching children about fractions. Knowledge of fractions falls into three strands: 1) procedural knowledge, 2) factual knowledge and 3) conceptual knowledge.

Caine, R.N. & Caine, G. (1994) "Making Connections: Teaching and the Human Brain"

Brain research demonstrates that the more senses used in instruction, the better learners will be able to remember, retrieve, and connect the information in their memories. By incorporating realistic, interdisciplinary activities that involve more than one of the child's senses, memory pathways become more easily accessed and cross-referenced for future use.

Invitation to Learn

Ask students if they are only called by one name. Have students discuss in small groups or share with the whole class different names people call them. Give the example of someone named "Richard". My friend Richard was called "Rich" by his girlfriend, "Rick" by his coach, "Ricky" by his Mom and "Richard" when he was in trouble. A boy named Robert was called a lot of different names, but they weren't bad names, just different names people called him. He was still the very same person even though he was known as Rob, Robby, Bob & Bobby—lots of names for the same person. Well, that's how it is with FREIDA FRACTION. Her friends call her ½, her Mom calls her 2/4, her Dad calls her his little 3/6 and Grandma calls her 4/8. Her teacher calls her 5/10 and on special occasions she is known as 6/12.

Instructional Procedures

Materials

- ❑ *Frieda Fraction*
- ❑ 1/2 Transparency
- ❑ Pattern Blocks
- ❑ Paper Folding Squares
- ❑ *Fraction Tree*
- ❑ *I've Got your Fraction*

1. Do the paper folding squares activity with students to demonstrate equivalent fractions.
2. Use *pattern blocks* and *Pattern Block Equivalent Fractions* worksheets.
3. When students seem to understand basic equivalent fractions, move on to *Fraction Tree* with pattern blocks. You may want to demonstrate with the whole class, them move on to working in small groups or partners and then independently.
4. Use *I've Got Your Fraction* game for review.

Assessment Suggestions

- Pre-assess each child's concept and understanding of fractions and equivalent fractions. This could be done in a journal writing experience. When was the first time you remember learning what"1/2" is? Write about it.
- Assess student understanding by checking their paper folding experience and *Fraction Tree* activities.
- Orally assess a student's understanding of equivalent fractions by having them describe to you how to know if fractions are equal.

Curriculum Extensions/Adaptations/ Integration

- Have advanced learners make Festive Fraction Books with examples of other equivalent fractions.
- Have matching game cards with equivalent fractions for students to play with a partner or in a concentration or war game on their own.

Family Connections

- Have students use fraction cards to play concentration, fish or war with parents at home.
- Have Student create a personal Frieda Fraction and different equivalent fractions. Make it into a poster or a short book.

Additional Resources

Web sites

http://mathforum.org/paths/fractions

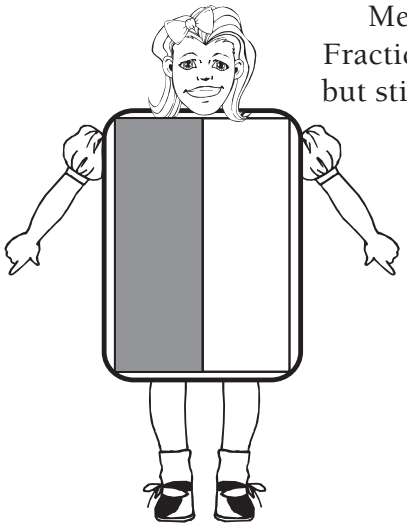
http://www.coolmath4kids.com/fractions/

http://www.edhelper.com/fraction.htm

http://www.math.com/homeworkhelp/HotSubjects.fractions.html

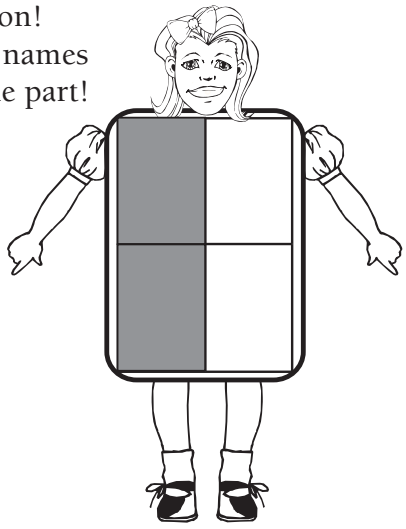
Frieda Fraction

Meet Freida Fraction!
Fractions have lots of names
but still name the same part!



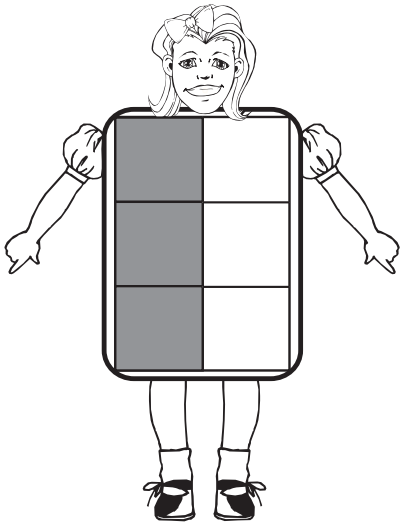
Friends
call her

$\frac{1}{2}$



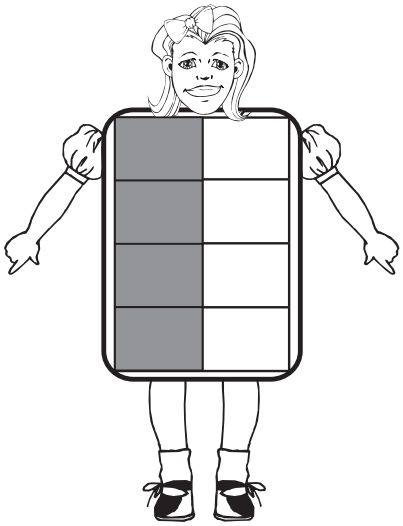
Mom
calls her

$\frac{2}{4}$



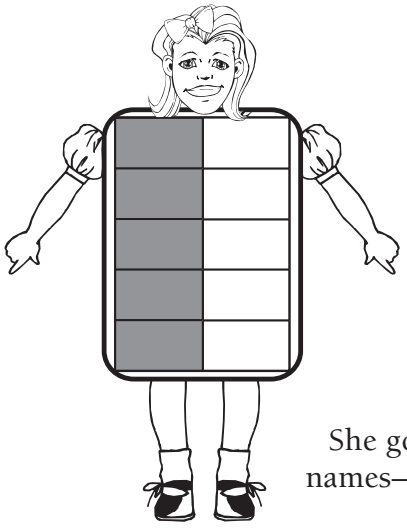
Dad
calls her

$\frac{3}{6}$



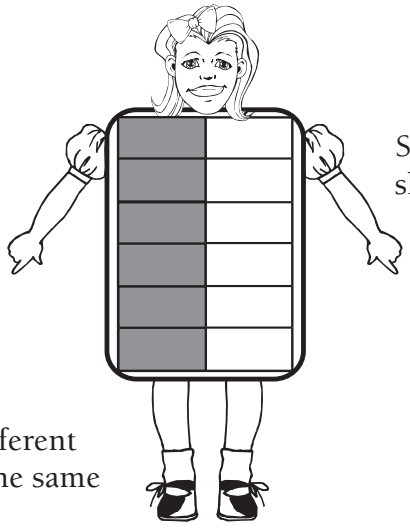
Grandma
calls her

$\frac{4}{8}$



Teacher
calls her

$\frac{5}{10}$

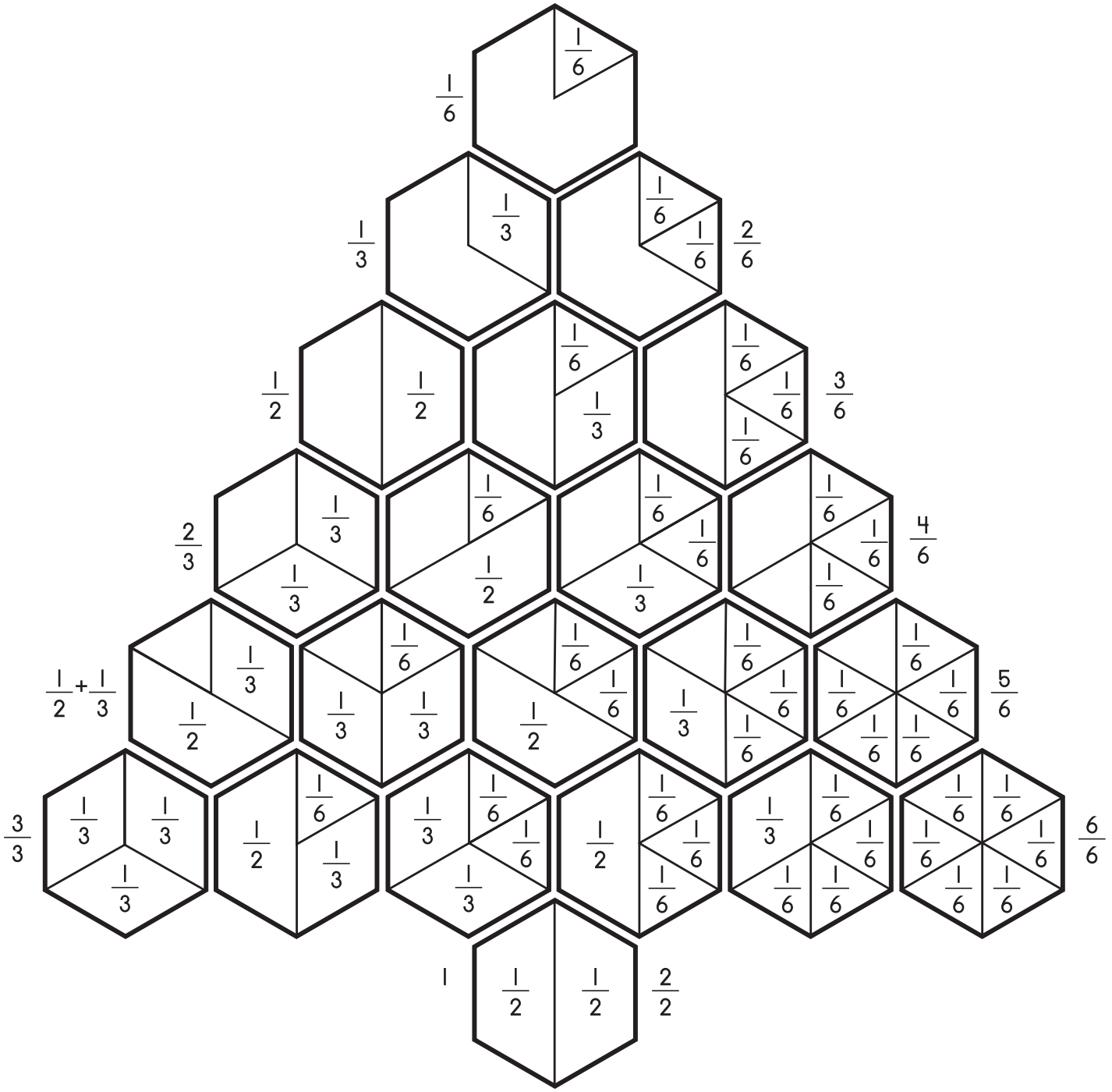


Sometimes
she's called

$\frac{6}{12}$

She goes by lots of different
names—but she's still the same
fraction!

Fraction Tree



I've Got Your Fraction – Game Cards

$\frac{1}{2}$	$\frac{2}{4}$	$\frac{3}{6}$
$\frac{4}{8}$	$\frac{5}{10}$	$\frac{6}{12}$
$\frac{1}{3}$	$\frac{2}{6}$	$\frac{3}{9}$

$\frac{4}{12}$	$\frac{1}{4}$	$\frac{2}{8}$
$\frac{3}{12}$	$\frac{1}{4}$	$\frac{2}{8}$
$\frac{3}{12}$	$\frac{1}{5}$	$\frac{2}{10}$

$\frac{1}{6}$	$\frac{2}{12}$	$\frac{2}{3}$
$\frac{4}{6}$	$\frac{6}{9}$	$\frac{8}{12}$
$\frac{2}{4}$	$\frac{4}{8}$	$\frac{6}{12}$

$\frac{3}{4}$	$\frac{6}{8}$	$\frac{9}{12}$
$\frac{2}{5}$	$\frac{4}{10}$	$\frac{3}{5}$
$\frac{6}{10}$	$\frac{4}{5}$	$\frac{8}{10}$

$\frac{4}{6}$	$\frac{8}{12}$	$\frac{5}{6}$
$\frac{10}{12}$		

The Power of ONE!

Standard I:

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

Objective 3:

Model and illustrate meanings of multiplication and division of whole numbers and the addition and subtraction of fractions.

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:

Math I-5; Add and subtract simple fractions

Math Standard I

Objective 3

Connections

Background Information

Students should be familiar and comfortable with the concept of what a fraction is and easily recognize and name fractions from halves to twelfths. Students should be able to name equivalent fractions.

Research Basis

Furner, J. M., & Duffy, M. L., (2001). Equity For All Students in the New Millennium: Disabling Math Anxiety

Research by Jackson & Leffingwell (1999) has shown that only 7% of Americans have had positive experiences with math from kindergarten through college. Similarly, Burns (1998) has contended that 2/3 of US adults fear and loathe math. Whether it is 93% or 2/3 of Americans who have negative math experiences, a problem clearly exists.

As teachers of mathematics, we need to make the learning engaging, fun and varied. We need to individualize the learning and the assessing to best meet the needs of each student in our class.

Invitation to Learn

Have you ever wanted to be #1? How did you feel when you were #1? Did you feel pretty powerful? Pretty cool? Pretty Smart? Number ONE is the most powerful number! It can transform or morph into an infinite number of forms of itself. To morph or transform it must be in the "Magic Box". (The magic box is a rectangle

divided in the middle with a fraction bar.) This is kind of like Clark Kent went into a phone booth (a magic box) and came out as another form of himself ----Superman!

POWER of ONE Skit—Brave teachers of Math will come dressed in some superhero costume of their choice to represent the powerful #ONE! It would be great to have a large box (e.g., one you could fit into that would open and shut). On the outside of the box draw a fraction bar. Prepare ahead of time fraction posters that are equivalent to ONE (e.g., 2/2, 3/3, 4/4, 5/5 etc). ONE transforms himself or morphs into the superhero he is needed to be at any moment for any problem. Watch as he appears in his secret identity to save the day for adding or subtracting fractions! Appear with the fractions that are equal to ONE hung around your neck. Ham it up---the kids will love it and they will remember it!

Instructional Procedures

Materials

- ❑ *Egg Carton Fraction*
- ❑ *Equivalent ONES*
- ❑ *Magic Box*

1. Do Superhero Power of ONE skit. Include a costume if possible and your Magic Box (phone booth) to transform into other form of the number one.
2. Give each student the *Magic Box* worksheet. Discuss that any fraction that is written in the *Magic Box* must be equal to ONE and therefore it will have the same numerator and denominator.
3. Discuss and demonstrate with pattern blocks, fraction strips, etc. that when a fraction is multiplied by another fraction that equals ONE, the original fraction's value does not change; it is just renamed.
4. Point out that when you multiply using the *Magic Box* and a form of ONE, you are always being fair and just to all fractions because you do the same thing to the numerator that you do to the denominator. Everyone has been treated fairly and numerators and denominators have been multiplied (or divided) by the same number.
5. Do several examples with manipulatives all together, in small groups, and then have students do problems on their own.
6. Place 12 objects on every student's desk. Ask them to show you 1/2? How do you know this 1/2? Use your hand to cover 1/2. Now cover 2/2. What is another name for 2/2?
7. Separate your objects into thirds. How do you know they are separated into thirds? Cover 1/3 of the objects. Now cover 2/3 of the objects. Now cover 3/3. Count and show me 1/3, 2/3, 3/3. What is another name for 3/3?

8. Repeat with fourths, & sixths. What is another name for 4/4? What is another name for 6/6?
9. Review with *Equivalent ONES* worksheet.

Assessment Suggestions

- Do a cooperative learning assessment. After having been taught the concept, have students assess their learning through journal writing. Ask them to write a brief description of what the have done. Have them describe how the activities with the manipulatives and the idea of one being a powerful number changed their perception of finding equivalent fractions.
- One way of getting students to think about the material they have learned is to have them write their own test. Ask them to imagine that they are the teacher. Instruct them as to exactly what topics need to be covered (e.g., Why is one a powerful number). Explain and give examples of how one changes itself to different forms. You may want to require that the test include one problem-solving situation, a reasoning question, or other requirement. Ask students to solve their own problems.

Curriculum Extensions/Adaptations/ Integration

- Have advanced learners teach struggling students the concepts.
- For learners with special needs, have them draw a super hero ONE of their own to remind them about changing fractions to equivalent fractions using the Magic Box and the Power of ONE.
- Compare and contrast with how things transform or change in science (e.g., rocks change from sedimentary to metamorphic, to igneous, etc). Have students brainstorm other things in nature and in life that are powerful because of their ability to change.

Family Connections

- Have students teach their parents or a sibling about the Power of ONE. Give extra credit for those that do this. If a student can teach the concept to someone else, then they truly understand. Have the make up their own problems to work with parents. Have parents sign and return the note for credit.

- Have students work with someone in their family to use the Power of ONE in a real life situation (e.g., recipes and fractions). Write about it in their journal and share with the class.

Additional Resources

Books

Painless Fractions, by Akyece B. Cummings; ISBN 10:0-7641-3439-6

Articles

Hecht, Steven Alan. (1998.) Toward an Information-Processing Account of Individual Differences in Fraction Skills. *Journal of Educational Psychology*. *90*. 545-59.

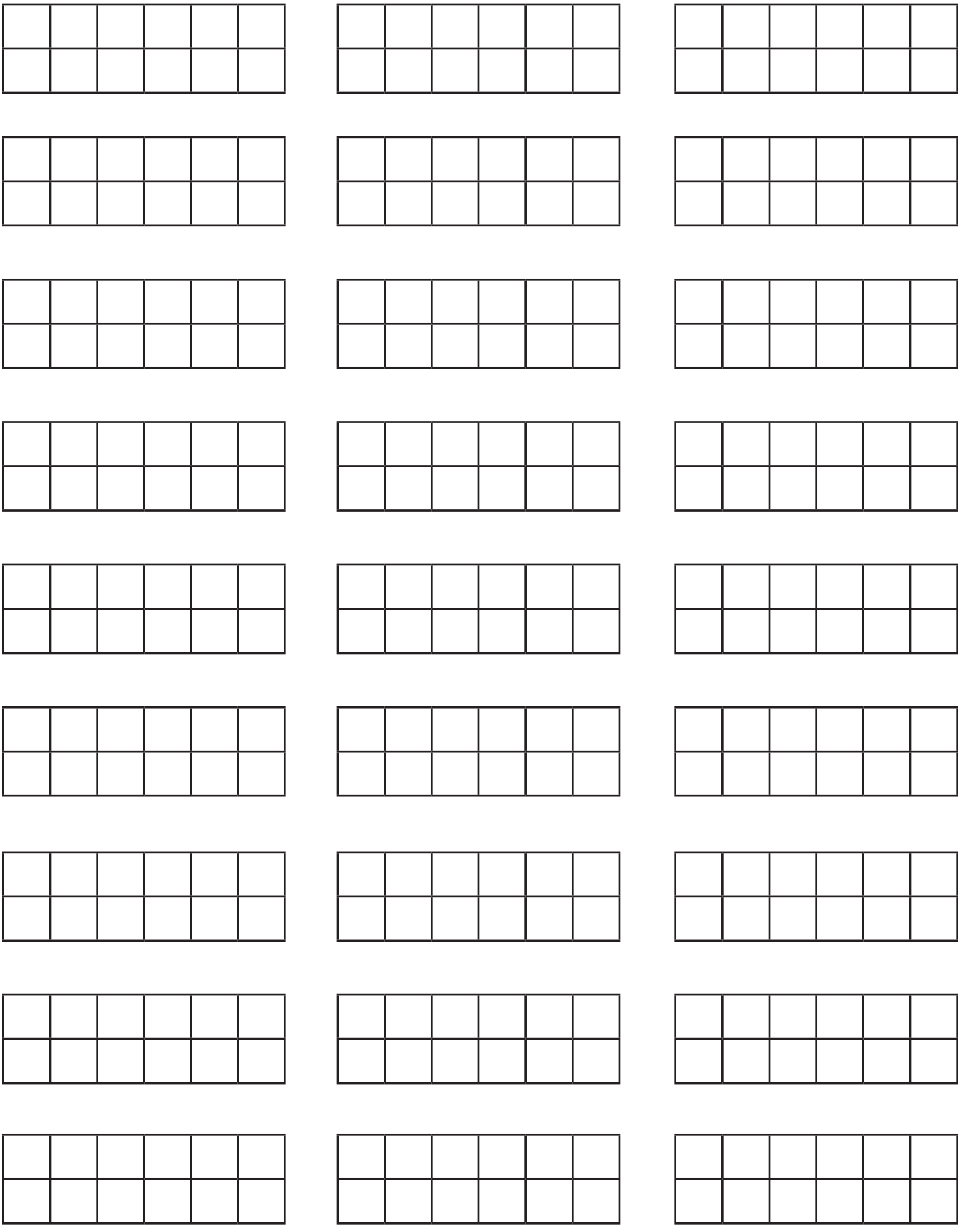
Web sites

http://www,visualfractions.com/

http://www.funbrain.com\fract

http://www.visualfractions.com/

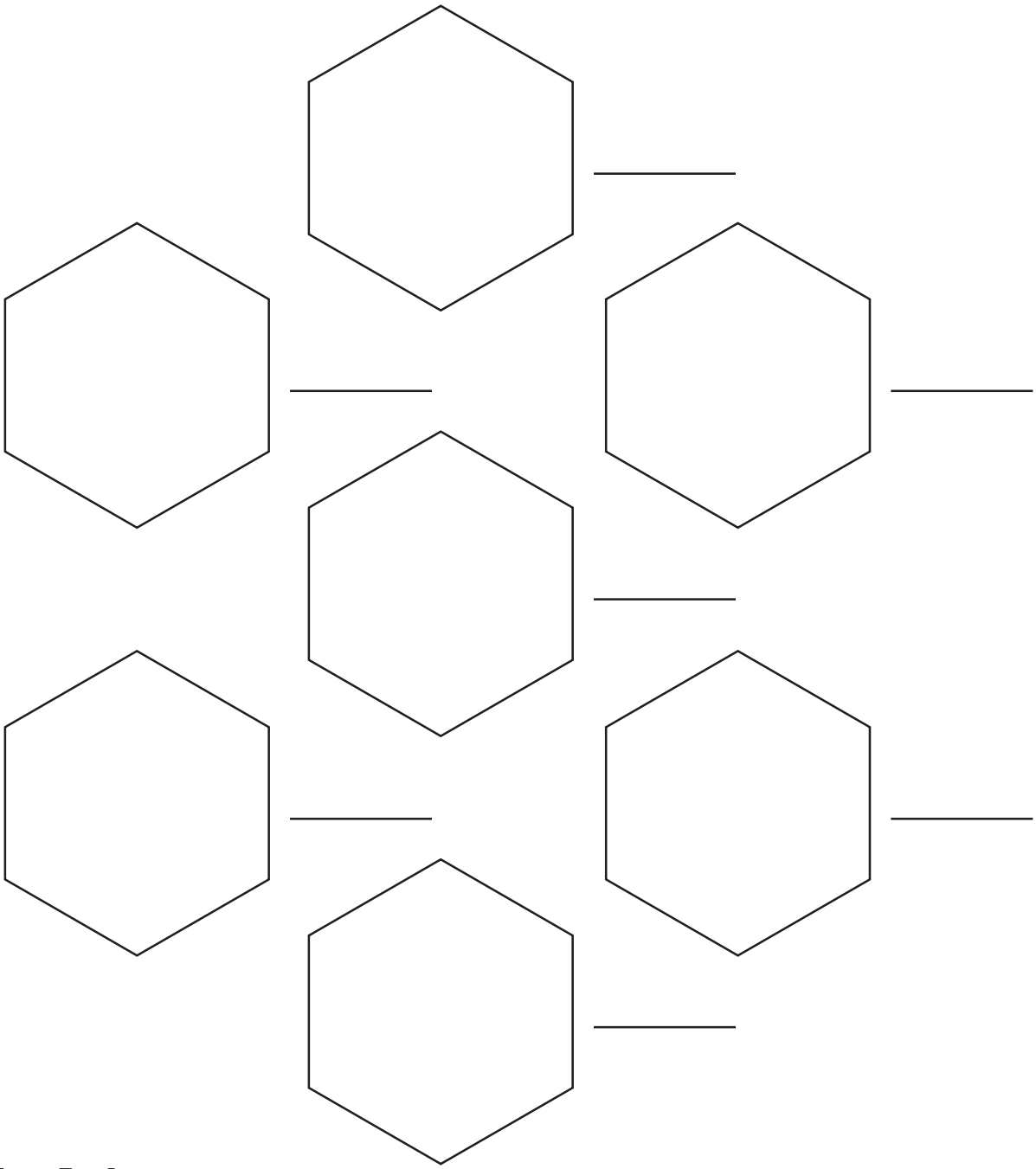
Egg Carton Fractions (blank)



Name _____ Date _____

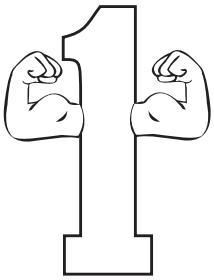
Equivalent Ones

Use pattern blocks to show different ways to equal 1. Trace your patterns for equivalent ones on the hexagons and write a fraction that is equivalent to 1 on the line.

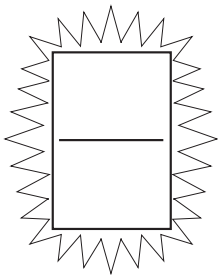


Have Fun!

Magic Box



Powerful One goes into the magic box and transforms into a fraction with the same numerator and denominator—it still equals 1! Complete the worksheet.



1. $\frac{2}{3} \times \frac{\square}{\square} = \frac{\quad}{9}$	2. $\frac{4}{5} \times \frac{\square}{\square} = \frac{\quad}{10}$	3. $\frac{1}{4} \times \frac{\square}{\square} = \frac{\quad}{12}$
4. $\frac{1}{2} \times \frac{\square}{\square} = \frac{\quad}{10}$	5. $\frac{1}{3} \times \frac{\square}{\square} = \frac{\quad}{6}$	6. $\frac{3}{4} \times \frac{\square}{\square} = \frac{\quad}{8}$
7. $\frac{1}{3} \times \frac{\square}{\square} = \frac{\quad}{9}$	8. $\frac{1}{2} \times \frac{\square}{\square} = \frac{\quad}{8}$	9. $\frac{2}{5} \times \frac{\square}{\square} = \frac{\quad}{1}$
10. $\frac{3}{4} \times \frac{\square}{\square} = \frac{\quad}{12}$	11. $\frac{1}{2} \times \frac{\square}{\square} = \frac{\quad}{6}$	12. $\frac{2}{3} \times \frac{\square}{\square} = \frac{\quad}{7}$

Delightfully Different Fractions!

Math Standard I

Objective 5

Connections

Standard I:

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

Objective 5:

Compute problems involving multiplication and division of whole numbers and addition and subtraction of simple fractions and decimals.

Intended Learning Outcomes:

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

Content Connections:

Math I-3; Model addition and subtraction of fractions.

Background Information

Students should be familiar with the concept of fraction and that a fraction is obtained when a whole is partitioned. When dealing with fractions, partitions must be of equal size. Students should understand that the total amount of material is not affected by partitioning.

The more partitions the whole is divided into, the smaller the pieces. The size of the partitions also depends on the size of the whole.

Students should realize that every fraction has an infinite number of names. It should also be understood that when a whole is partitioned, the numerator and the denominator are increased by the same factor. Students should be familiar with equivalent fractions and feel comfortable adding and subtracting fractions with the same denominators.

Research Basis

Jensen, E. (1999). Teaching with the Brain in Mind. *Association for Supervision and Curriculum Development*, Alexandria, VA.

To our brain, we are either doing something we already know how to do or we are doing something new. Repetition of previous learning is likely to make the neuron pathways more efficient and therefore makes the brain more efficient. Reviewing what students already know on a regular, daily basis has great benefits. Reviewing and assessing what students already know about a concept helps them make more connections.

Memory is the only real evidence of learning. Lasting learning seems to be a function of the repeated electrical stimulations of a neuron. Quality education will provide multiple and varied explorations of concepts for increased connections and advanced memory.

Invitation to Learn

Play "Multiples Game". Have all students stand around the room. Call out a number from 1 to 12. When the number is called, students must get into groups the size of the number that was called and lock arms. Any one not in a group stands out. A different number is called each round. Call out numbers that are factors of 12 (2, 3, 4, 6, 12) to begin. Then call out a number that is not a factor of 12 (e.g. 5, 7, 8). Discuss with students why when you called out 5, why did classmates have to stand out. Why did no one leave the game when you called out 2 or 3 or 4 or 6 or 12? Everyone got into a new sized group but no one was eliminated. What could we deduce from this? Lead the discussion to multiples and what numbers divide evenly into 6, 8, 9 & 12.

Instructional Procedures

When denominators are DELIGHTFULLY DIFFERENT (like apples & oranges), you must find a common denominator before you can add or subtract the fractions. This is like mixing the fruit together in a fruit salad!

1. Sing *Fraction Song*.
2. Fraction Masquerade—Did you know that fractions wear masks? They wear masks every day of the week, not just on Halloween. You often put masks on fractions to make them easier to add or subtract. These masks come out when the fraction is renamed so it can be added or subtracted.
3. Give each student their 12 small objects. Have them separate into halves, thirds, fourths, sixths and twelfths using their egg cartons. Although they can show halves, thirds, etc. in many different ways, it is easier to identify the fractional part if they put objects close together, side by side. Discuss multiples.
4. Complete *Egg Carton Fractions* worksheet. Have students use their objects and egg cartons to work out problems.

Materials

- ❏ Egg cartons
- ❏ Small objects
- ❏ *Egg Carton Fractions*
- ❏ *Pattern Block Equivalent Fractions*
- ❏ *Fruit Salad*
- ❏ *Fruit Salad Fractions*
- ❏ Overhead fraction pieces
- ❏ Pattern Blocks
- ❏ *Fraction Song*

5. Have students explore with pattern blocks and come up with equivalent fractions. Remind them of the Power of ONE and the magic box as a way of creating equivalent fractions.
6. Work with students to find common denominators for basic fractions using the pattern blocks.

Assessment Suggestions

- Allow students to use pattern blocks, an egg carton, or fraction bars when testing.
- For struggling students who stress over a paper and pencil assessment, have them demonstrate with one of their manipulatives and describe orally how they add or subtract fractions with different denominators.

Curriculum Extensions/Adaptations/ Integration

- Using the fractions that have different denominators, have advanced students write and illustrate their own book about what could happen to a fourth grader during the day.
- List adaptations for learners with special needs.
- Include ideas for integration for other curricular areas (use appropriate subject area headings).

Family Connections

- Have students do the *Fruit Salad* worksheet at home with a parent. Let them teach their parent, older brother or sister or other adult about common denominators and the adding and subtracting of fractions. Have parents sign and return worksheet for a small reward or extra credit.
- Let students check out a set of pattern blocks to take home to teach a parent to find common denominators using pattern blocks. Have them do one worksheet (have parents sign) and then have them come up with an addition or subtraction problem of their own using pattern blocks. Give extra credit for those who return the worksheet signed.

Additional Resources

Books

The Doorbell Rang, by Pat Hutchings, ISBN978-0-688-09234-4

Reys, R. E., Suydam, M. N., and Lindquists, M. M. (1995). ***Helping Children Learn Mathematics, 4th ed.*** Needham Heights, MA: Allen and Bacon.

Web sites

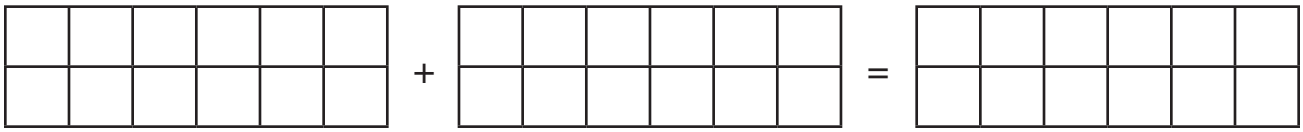
http://www.aplusmath.com/Flashcards/fractions-mult.html

http://math.rice.edu/-lanius/Patterns/

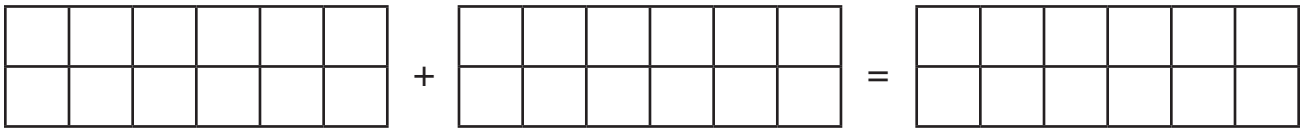
http://www.highwired.com/Classroom/Project/0,2069,23713-68258,00.html

Egg Carton Fractions

1. 1/2 + 1/3 =

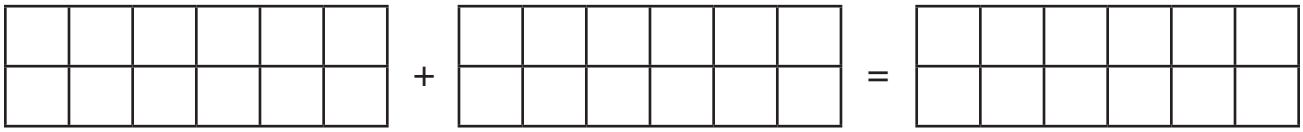


2. 1/2 + 1/4 =

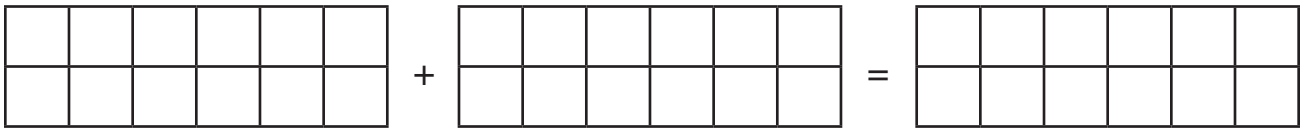


3. 1/4 + 1/3 =

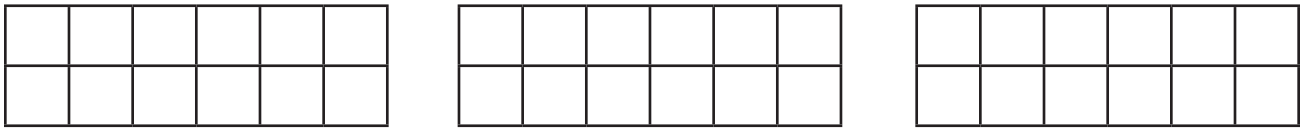
4. 2/3 + 1/6 =



5. 1/2 + 1/6 =



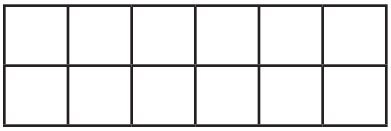
6. 5/6 + 1/12 =



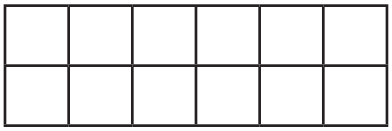
Egg Carton Subtraction - Missing Addend

Jan has 1/4 of a dozen eggs, but needs 2/3 of a dozen eggs to make custard. What part of a dozen does Jan need?

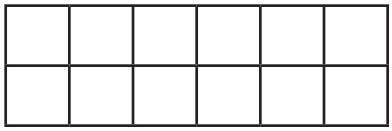
7. 1/4 + _____ = 2/3



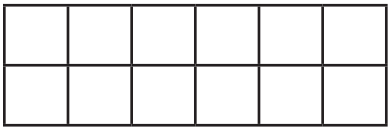
8. 2/3 + _____ = 3/4



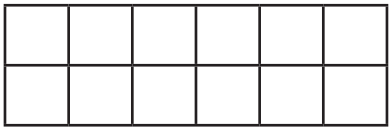
9. 1/2 + _____ = 5/6



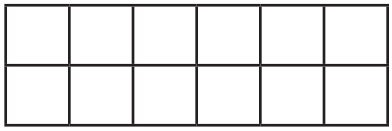
10. 1/4 + _____ = 5/12



11. 1/2 - 1/3 = _____



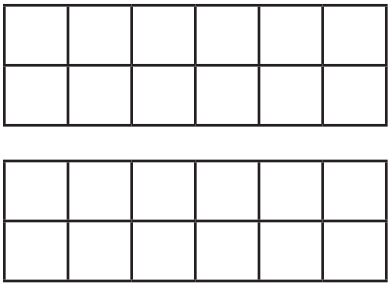
12. 3/4 - 2/3 = _____



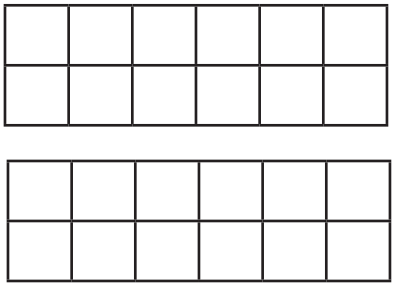
Subtraction - Comparison

Which is bigger and by how much?

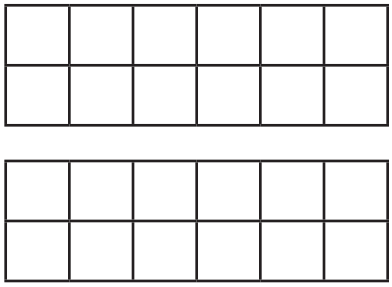
13. 2/3 - 1/4 = _____



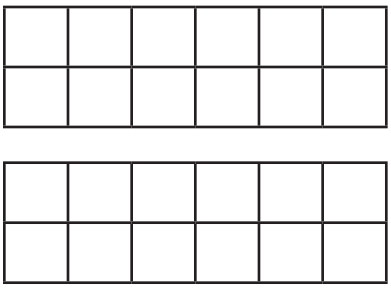
14. 3/4 - 2/3 = _____



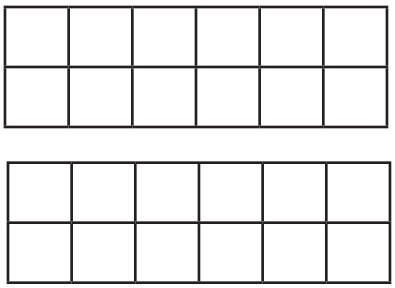
15. 5/6 - 1/2 = _____



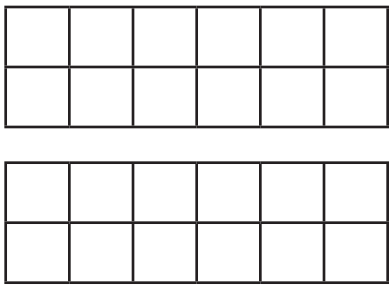
16. 5/12 - 1/4 = _____



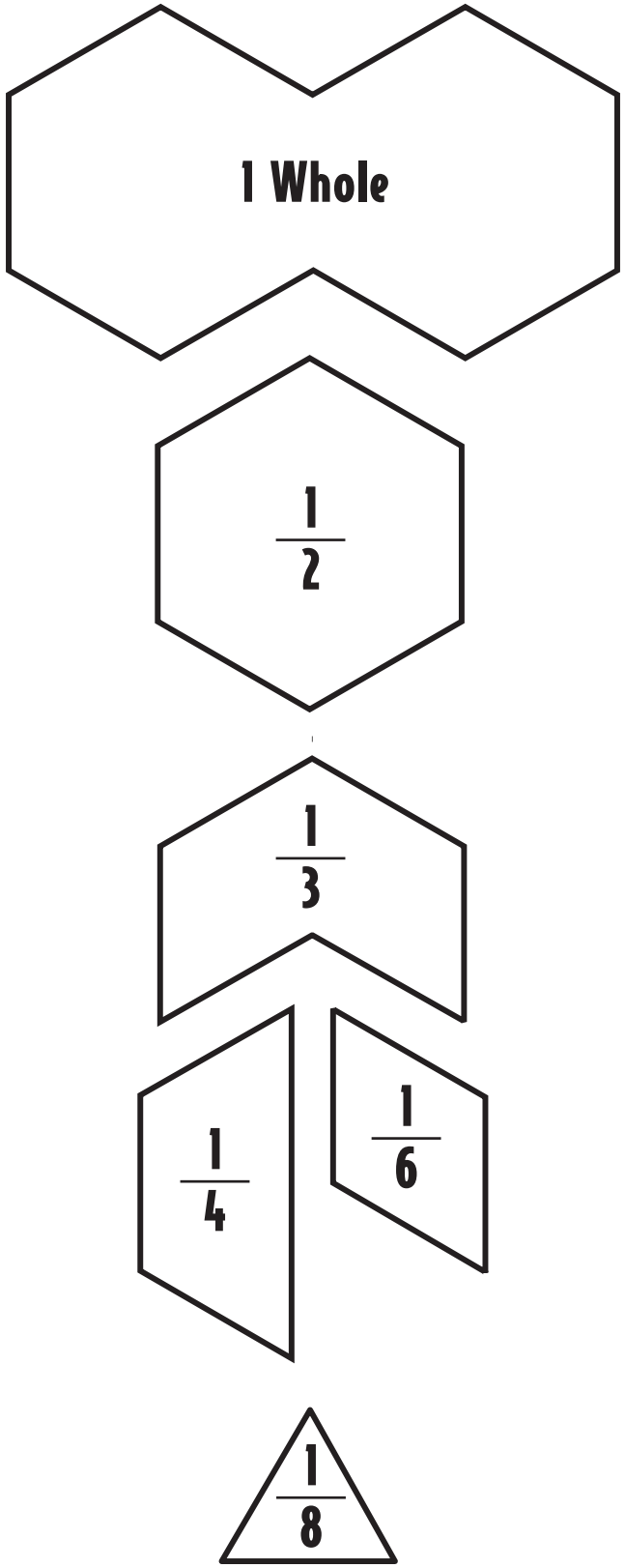
17. 1/2 - 1/3 = _____



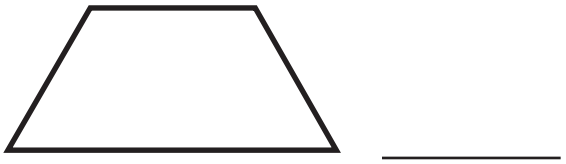
18. 3/4 - 2/3 = _____

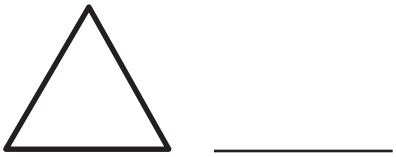


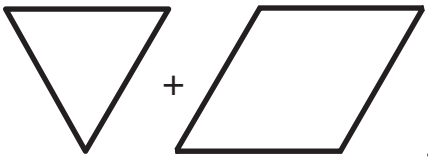
Pattern Block Equivalent Fractions

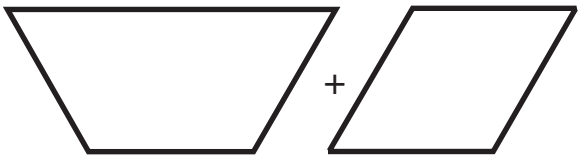


Pattern Block Equivalent Fractions

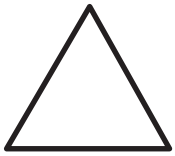


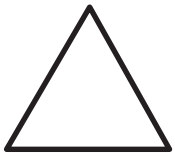
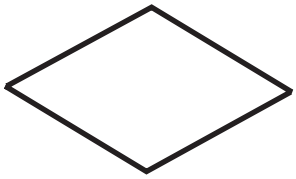


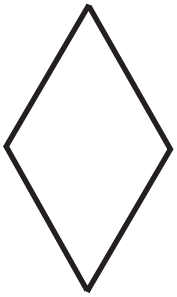
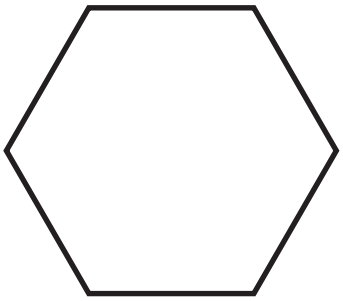


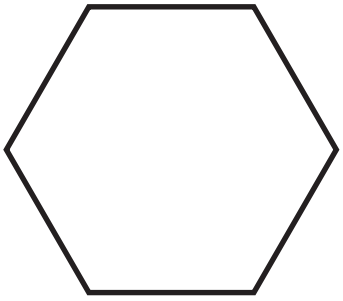


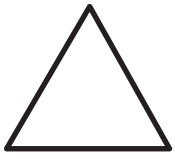
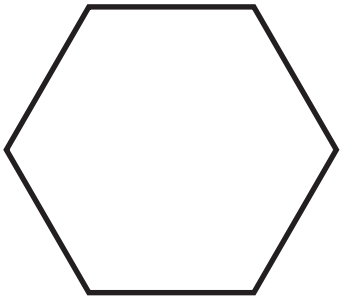
Pattern Block Equivalent Fractions

How many  **Cover (equal)**  **?** _____

How many  **Cover (equal)**  **?** _____

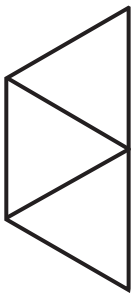
How many  **Cover (equal)**  **?** _____

How many  **Cover (equal)**  **?** _____

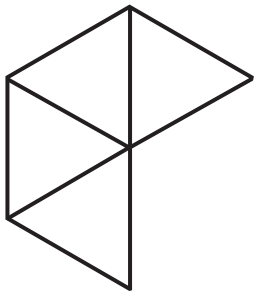
How many  **Cover (equal)**  **?** _____

Pattern Block Equivalent Fractions

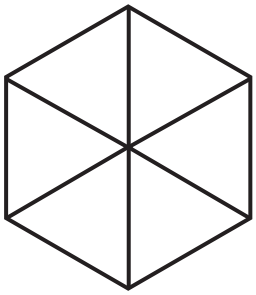
What is the largest piece that can fit in the pieces? How many times will it fit?



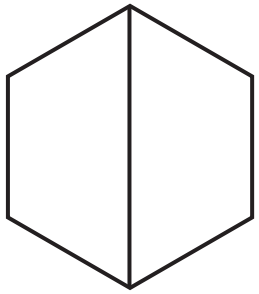
$\frac{3}{6} = ?$



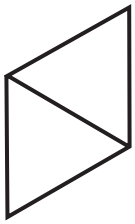
$\frac{4}{6} = ?$



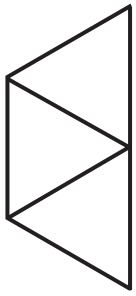
$\frac{6}{6} = ?$



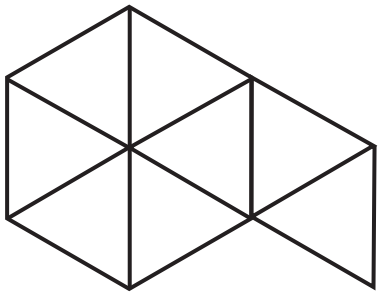
$\frac{2}{4} = ?$



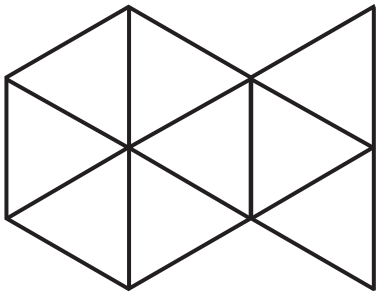
$\frac{2}{12} = ?$



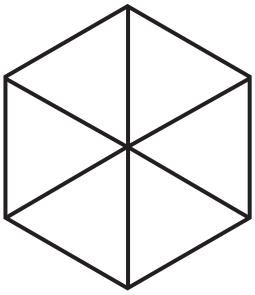
$\frac{3}{12} = ?$



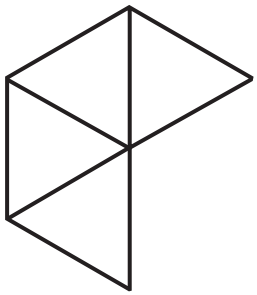
$\frac{8}{12} = \_\_\_$



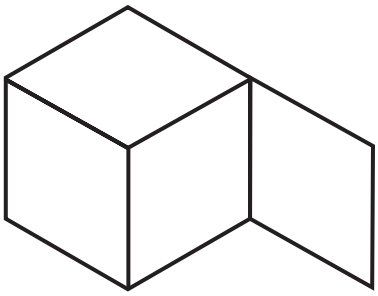
$\frac{9}{12} = \_\_\_$



$\frac{6}{12} = \_\_\_$

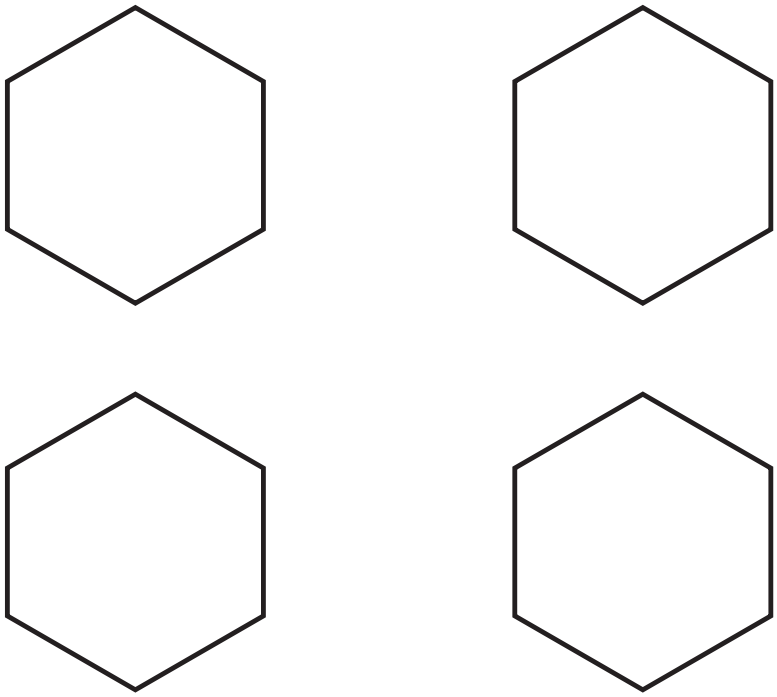


$\frac{4}{12} = \_\_\_$

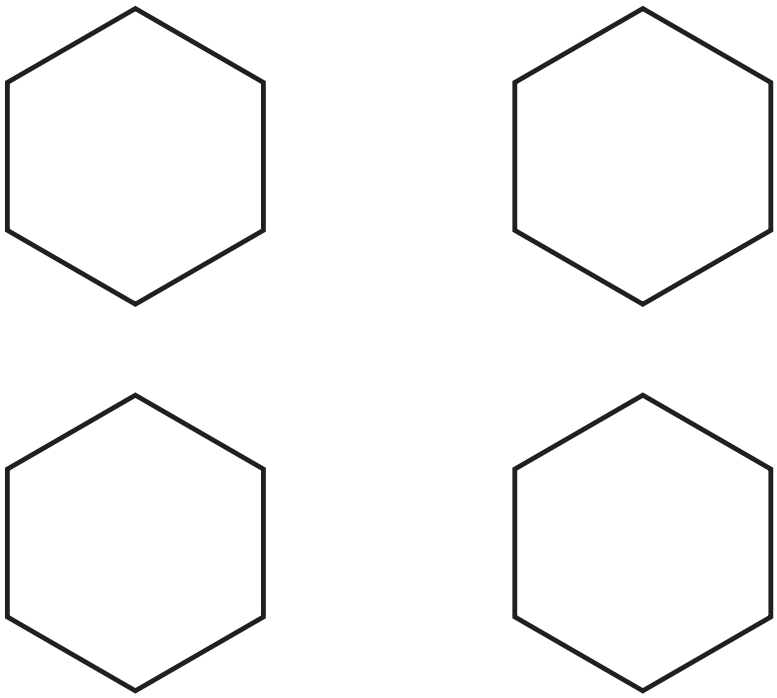


$\frac{4}{6} = \_\_\_$

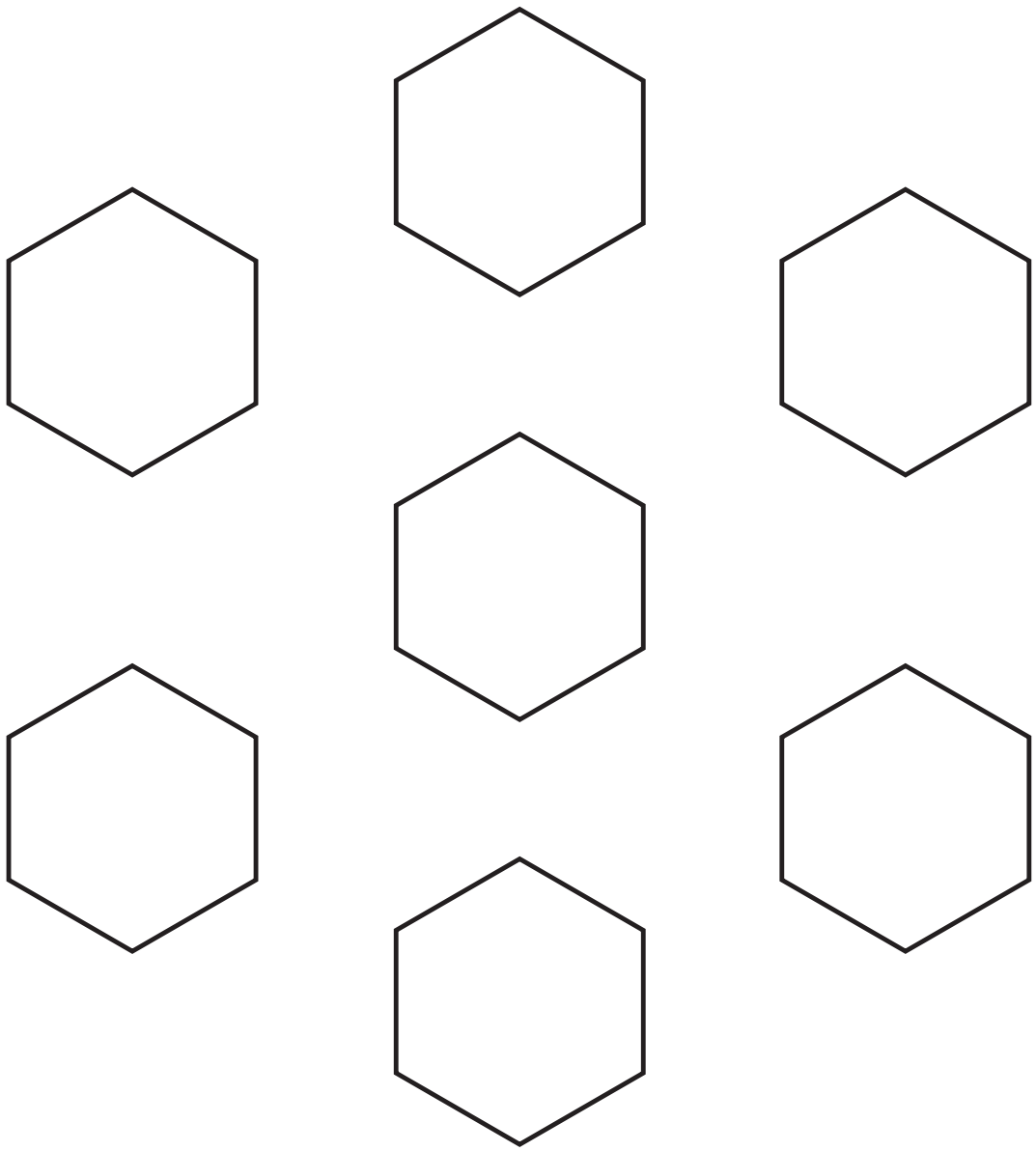
Show 4 different ways to show 4/4.



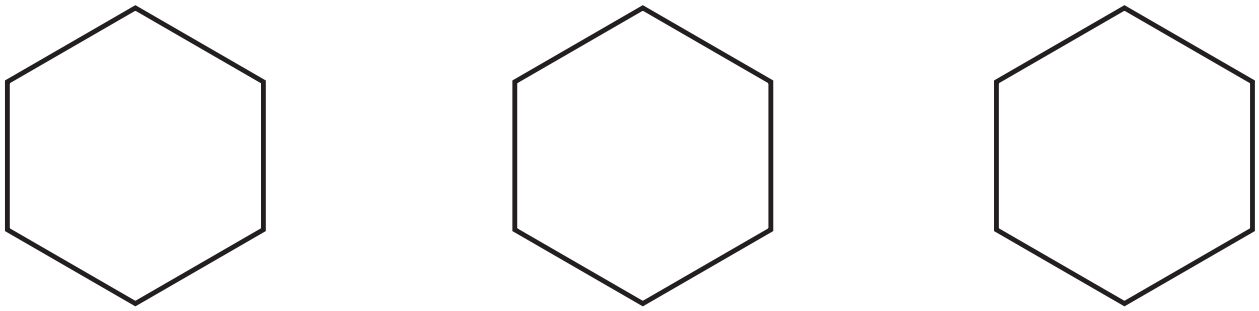
Show 4 different ways to show 4/4.



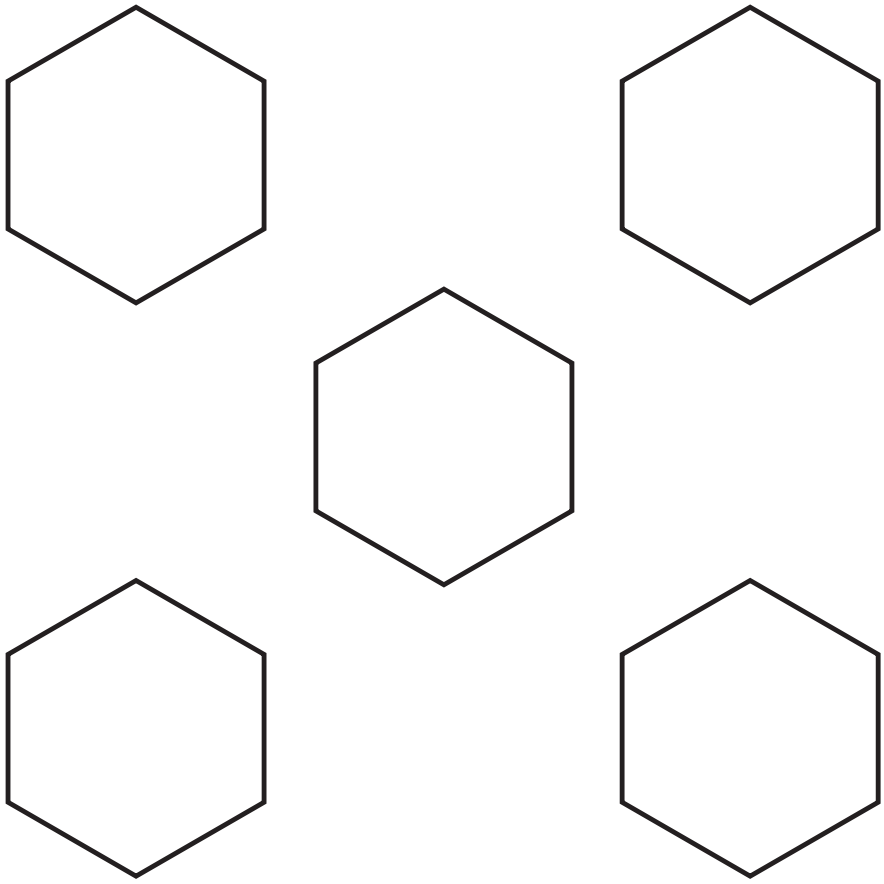
Show 7 different ways to show 6/6.



Show 3 different ways to show 3/6.



Show 4 different ways to show 4/4.



Show the following equations using Pattern Blocks:

- **Explain your answer to your neighbor**
- **Explain your answer in your journal**

$\frac{1}{6} + \frac{1}{3} = \frac{3}{6}$ or $\frac{1}{2}$

$\frac{1}{6} + \frac{2}{3} = \frac{5}{6}$

$\frac{2}{6} + \frac{1}{3} = \frac{4}{6}$ or $\frac{2}{3}$

$\frac{2}{6} + \frac{2}{3} = \frac{6}{6}$ or 1

$\frac{1}{6} + \frac{1}{2} = \frac{4}{6}$ or $\frac{2}{3}$

$\frac{3}{6} - \frac{1}{3} = \frac{1}{6}$

$\frac{5}{6} - \frac{2}{3} = \frac{1}{6}$

$\frac{4}{6} - \frac{1}{3} = \frac{2}{6}$ or $\frac{1}{3}$

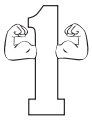
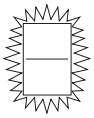
$\frac{6}{6} - \frac{2}{3} = \frac{2}{6}$ or $\frac{1}{3}$

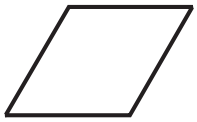
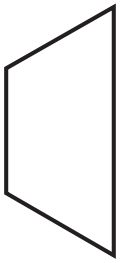
$\frac{4}{6} - \frac{1}{2} = \frac{1}{6}$

$\frac{5}{6} - \frac{1}{3} = \frac{1}{2}$

$\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$

Adding & Subtracting with Pattern Blocks

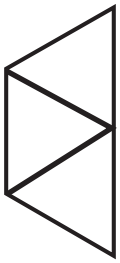
Use the power of  **and the Magic Box.** 

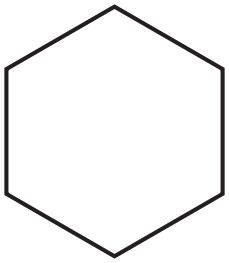
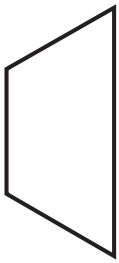
$\frac{1}{2} + \frac{1}{4}$  +  =

Rename

$\frac{1}{2}\square = \frac{1}{4}$

$\frac{1}{4}\square = \frac{1}{4}$

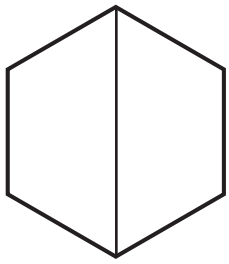
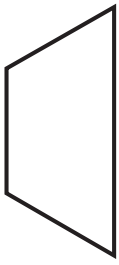
 +  =

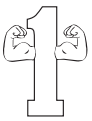
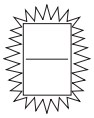
$\frac{1}{6} + \frac{1}{4}$  +  =

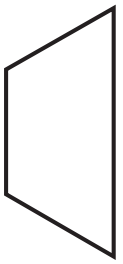
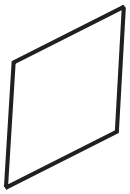
Rename

$\frac{1}{6}\square = \frac{2}{12}$

$\frac{1}{4}\square = \frac{3}{12}$

 +  =

Use the power of  **and the Magic Box.** 

$\frac{1}{2} + \frac{1}{3}$  $+$  $=$

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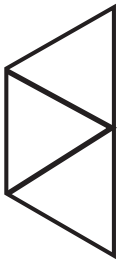
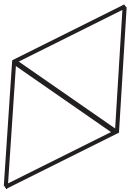
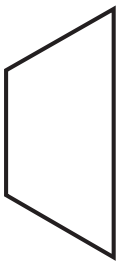
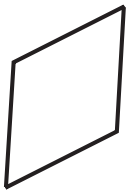
$\frac{1}{2} \square = \frac{3}{6}$  $+$ $\frac{1}{3} \square = \frac{2}{6}$  $=$

$\frac{1}{2} - \frac{1}{3}$  $-$  $=$

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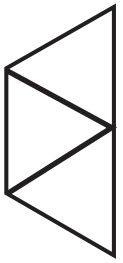
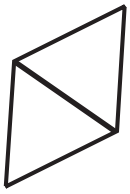
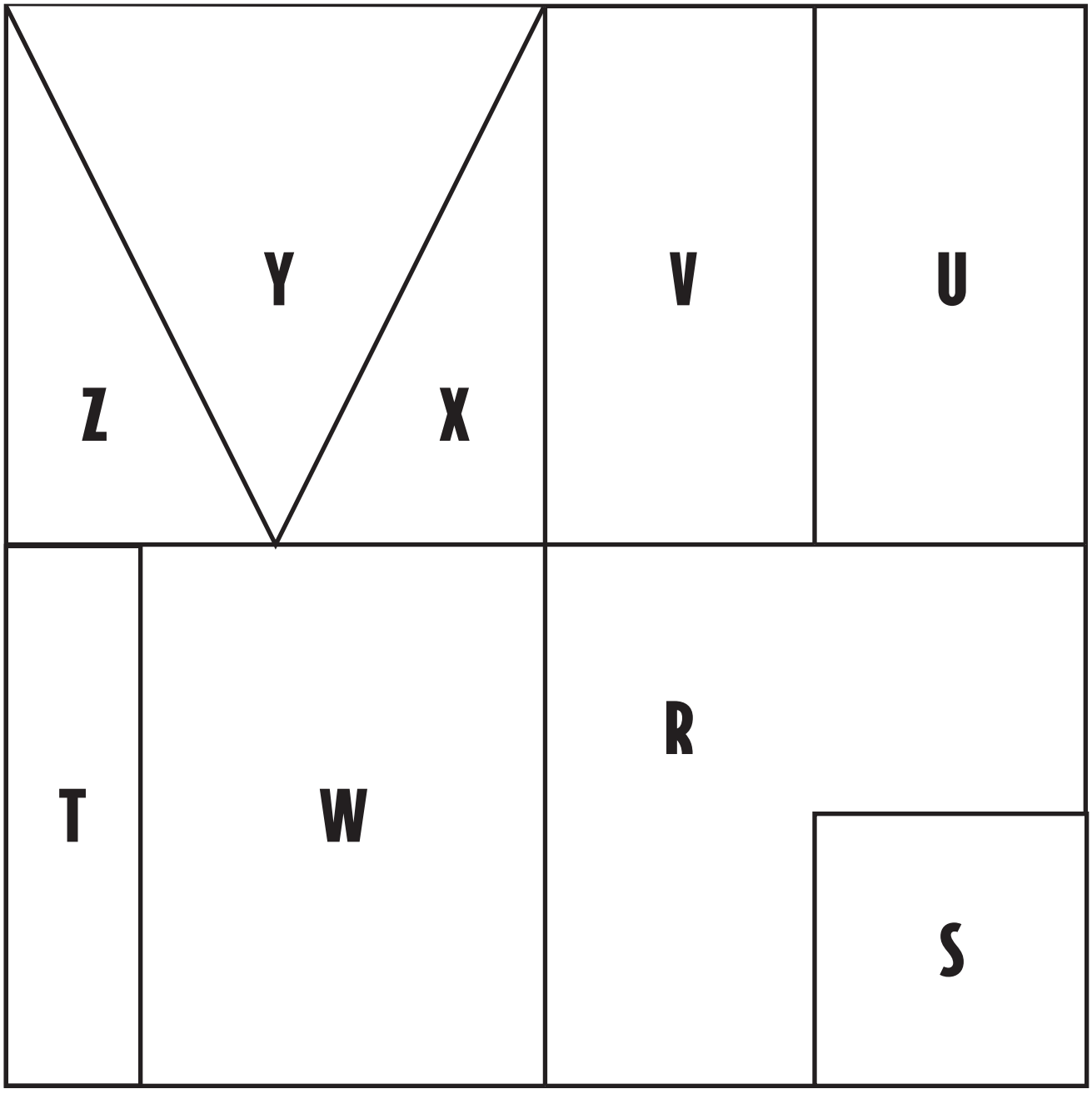
$\frac{1}{2} \square = \frac{3}{6}$  $+$ $\frac{1}{3} \square = \frac{2}{6}$  $=$

Square Fractions

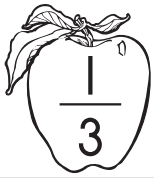
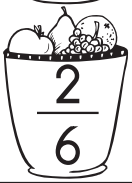


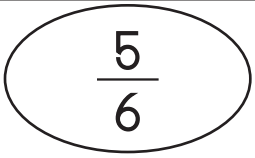
Name _____ Date _____

Fruit Salad

Home/School Connection: If you have Delightfully Different Denominators (like apples and oranges) you have to make Fruit Salad to add or subtract fractions!

1.  $\frac{3}{3}$ = 

\+  $\frac{2}{2}$ = 



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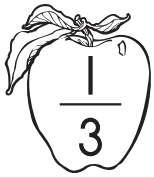
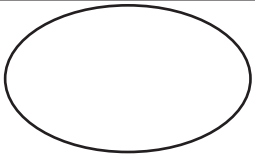
\+  = 



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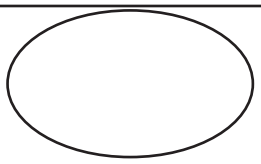

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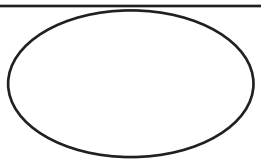

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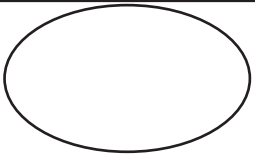


Parent Signature

Name _____ Date _____

Fruit Salad Fractions

Home/School Connection: If you have Delightfully Different Denominators (like apples and oranges) you have to make Fruit Salad to add or subtract fractions!

1. $\frac{1}{3}\square = \_\_$

   $-\ \frac{1}{6}\square = \_\_$

2. $\frac{1}{5}\square = \_\_$

   $+\ \frac{1}{2}\square = \_\_$

3. $\frac{1}{4}\square = \_\_$

   $+\ \frac{1}{3}\square = \_\_$

4. $\frac{2}{3}\square = \_\_$

   $+\ \frac{1}{6}\square = \_\_$

5. $\frac{1}{2}\square = \_\_$

   $+\ \frac{1}{4}\square = \_\_$

6. $\frac{5}{6}\square = \_\_$

   $+\ \frac{1}{12}\square = \_\_$

7. $\frac{5}{12}\square = \_\_$

   $-\ \frac{1}{4}\square = \_\_$

8. $\frac{3}{4}\square = \_\_$

   $-\ \frac{2}{3}\square = \_\_$

9. $\frac{2}{3}\square = \_\_$

   $-\ \frac{1}{4}\square = \_\_$

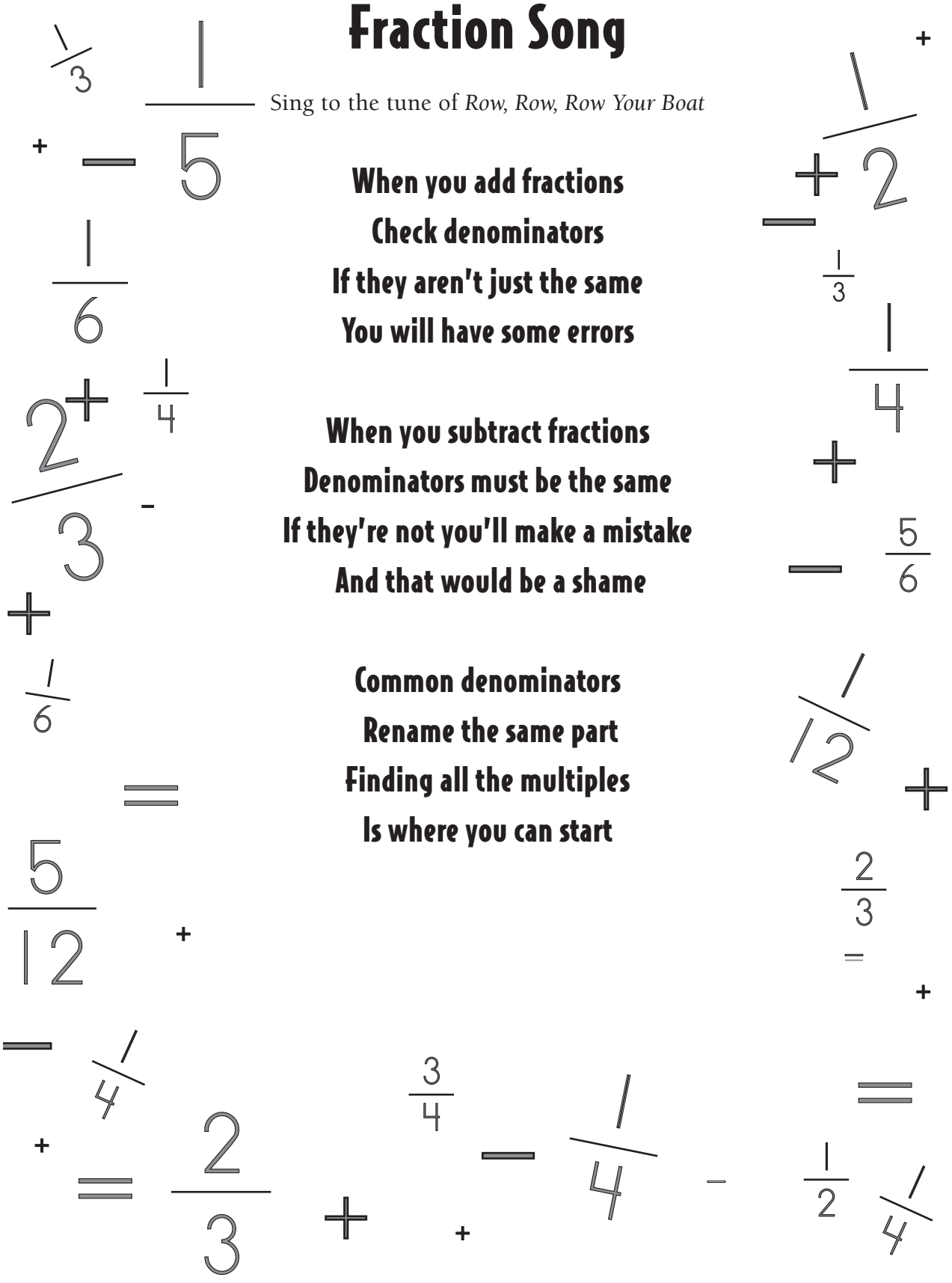
Fraction Song

Sing to the tune of *Row, Row, Row Your Boat*

When you add fractions
Check denominators
If they aren't just the same
You will have some errors

When you subtract fractions
Denominators must be the same
If they're not you'll make a mistake
And that would be a shame

Common denominators
Rename the same part
Finding all the multiples
Is where you can start



Science III-2

Activities

Weathering Soils

Take a Tumble

Science Standard III

Objective 2

Connections

Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by the soil.

Objective 2:

Explain how the processes of weathering and erosion change and move materials that become soil.

Intended Learning Outcomes:

1. Make simple predictions and inferences based upon observations.
2. Compare things and events.
3. Use instruments to measure length, temperature, volume, and weight using appropriate units.
4. Conduct a simple investigation when given directions

Content Connections:

Math IV-1; Measuring mass, length & volume

Background Information

Have you ever seen those bright, polished rocks in tourist shops? Have you wondered how they were made? Rock hounds use rock tumblers or rock polishers to make rough rocks smooth and shiny. By placing rocks in small barrels with grit and water and letting them tumble—much like clothes in your dryer at home—you can have them rub and grind against grit and each other to smooth their surfaces and knock off edges. It has been calculated that every 24 hours a rock is worked in a tumbler is equivalent to traveling 4.3 kilometers (2.7 miles) in a stream. With this in mind, rock tumblers are a great way to simulate mechanical or physical weathering in your own classroom.

At the most basic level, *weathering* is the process by which rock is broken down into smaller pieces, and *erosion* is how those smaller pieces (e.g., the tiny bits of rock and minerals that make up soil) are moved or carried away. Weathering can be divided into two types: *mechanical* or (*physical)* weathering, in which the chemical makeup of the rock is unchanged during the breakdown; and *chemical* weathering, in which a change occurs in the chemical makeup of the rock that then causes it to break down.

Start by providing rocks for the students that are of the same relative hardness on the Mohs scale of mineral hardness. Limestone, shale, or marble are good choices for our simulation because these rocks are made of particles that are well cemented but still soft enough to show weathering over a few days of tumbling. Harder rocks like jasper, agate, or tiger eye are typically tumbled, but take 3 to 4 weeks

to polish and smooth—much longer than you may have with your students. Students really take ownership for their rocks, and if a softer rock is placed in with hard rocks, it could tumble completely away.

Size of rocks also matters. Provide rocks that are slightly larger than a toy marble. A double barrel tumbler with 3 lb barrels (the weight the barrel can hold) will be sufficient for use with a class of students. Label the barrels and have half of your students place their rock in one barrel and the rest in the other. Have the students record in which barrel they placed their rock. In this way they will need to distinguish their rock from only the other rocks in their barrel rather than from the whole collection of rocks.

The students will also be asked to measure different characteristics of their rocks. They could measure their rock with a ruler but they may not be able to do so accurately enough to distinguish change in their rock's size. Calipers are used to measure three-dimensional objects and can be used by students to more accurately measure the width and thickness of their rock.

Measuring the volume of their rock could also be new for them. Placing their rock in a graduated cylinder with a specific amount of water and then calculating the amount of water that is displaced will provide students with the volume of their rock.

Research Basis

Chesbro, R., (2006). Using Interactive Science Notebooks for Inquiry-Based Science. *Science Scope*. 29(3) 30-34.

The interactive science notebook is an opportunity for students to create and use a notebook that represents their science learning throughout the year. Interactive science notebooks enhance learning by encouraging students to write across the curriculum and promote personal connections to learning.

Klentschy, M., (2005). Science Notebook Essentials. *Science & Children*.

This article focuses on the effective components of student science notebooks and their use as an effective teaching tool to assist students in developing a deeper *understanding of science content*.

Invitation to Learn

Give each student a rock and tell them that they are going to play an identification game with their rocks. Each of them will need to describe their rock in detail in their journal so that they can identify it when it is put with the rocks from the other members of the class. Ask what type of characteristics they could use to identify their rocks.

Have them identify the visual characteristics such as color, texture, shape and distinguishing marks. After they have done this have them use the calipers to measure the length and width of the rocks. Use a scale to measure the mass of the rock. And then have them measure the volume of their rock using a graduated cylinder with a specific amount of water inside.

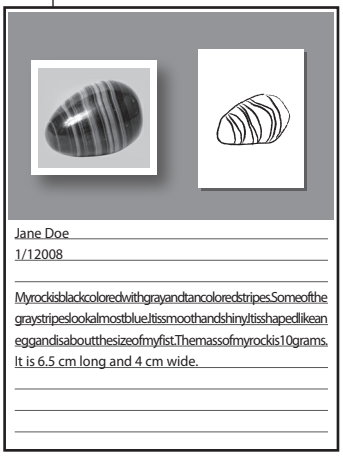
After they have identified their rock, have them team up with three other students to take a picture of their rocks placed on the *Photo Mat* (see blackline masters.). Four students will place rocks on the 4 sections of one photo mat. One picture will be taken of the photo mat; after it is printed the picture will be cut four ways.

Have the students place their rocks into the rock tumbler with 4 tablespoons of grit and enough water to fill the barrel two-thirds to three-fourths of the way. Seal the containers and begin the tumbling process.

When disposing of the used grit, do not pour it down a sink drain. The grit is heavy and will clog the sink and make it difficult to unclog.

Materials

- ❏ *Photo Mat*
- ❏ Rock tumbler
- ❏ Silicone Carbide Grit
- ❏ Rocks
- ❏ Calipers
- ❏ Scale or balance
- ❏ Graduated cylinders
- ❏ Camera
- ❏ Photo mat
- ❏ Student journals
- ❏ Colander
- ❏ Dish pan



Jane Doe
1/12008

My rock is black colored with gray and tan colored stripes. Some of the gray stripes look almost blue. It is smooth and shiny. It is shaped like an egg and is about the size of my fist. The mass of my rock is 10 grams. It is 6.5 cm long and 4 cm wide.

Instructional Procedures

Make Rock Journal Entries

1. Have students compile their data in a journal entry. (See suggested format in sketch.)
2. Have the students write a prediction of how their rock will change. Go so far as to guess the mass, volume and length measurements.
3. After a week's period of time, open the rock tumbler, dump it into a colander and separate the rocks from the grit and water. Save the grit and water. Without adding more water to the gritty water, rinse and dry the rocks.
4. Have the students select their rock using their journal entry. There may be some disputation regarding true ownership of a rock. This would be a good time to have a discussion on the importance specific and accurate scientific explanations.
5. Have the students describe the changes that have taken place in their rock.
6. Have the students again describe the visual characteristics, length, mass, and volume measurements for their rock.

7. If there hasn't been substantial change, place the grit and dirty water back into the rock tumbler and return the rocks to the tumbler.
8. Repeat the rock tumbling again for another week and repeat steps 1-6 above. Remember to not dispose of the grit by rinsing it down a sink drain.

   It is import to discuss the observations that the students make. Here are some questions that could be used as part of the discussion:

   - How has your rock changed? Is this what your predicted?
   - Did something happen that surprised you?
   - Why do you think the tumbler water changed color?

Assessment Suggestions

- Teacher observation of activity and discussion.
- Journal Entry using a rubric you and your students have made or the one supplied.

Curriculum Extensions/Adaptations/ Integration

- Tumble a batch of rocks (all of the same relative hardness) and compare how different rocks resist weathering.
- Tumble a batch of jasper or agate through the entire polishing process (usually 4-6 weeks) using different grades of grit and polish.
- Make a line graph representing the data for the weathering of the rock.

Additional Resources

Books

How to Tumble Polish Gemstone, by Jerom Wexler; ISBN 0-9351-8237-3

Geology Crafts For Kids: 50 Nifty Projects to Explore the Marvels of Plane Earth, by Alan Anderson, Gwen Diehn, & Terry Krautwurst; ISBN 0-8069-8157-1

Exploring Earth's Treasures (Eyes on Adventure), by Donald Olson; ISBN 1-5615-6481-8

Media

Earth Science Collection. Weathering & Erosion. by 100% Education Videos, Inc. (1-800-483-3383, http://pioneer.uen.org/k12/) After logging into Pioneer, select eMedia from the general references list, and search by title.

Articles

"Take a Tumble," ***Science Scope***, (March 2006), National Science Teachers Association; ISSN 0887-2376

Web sites

http://geology.com/rock-tumbler/

http://www.geography4kids.com/files/land_weathering.html

Organizations

American Federation of Mineralogical Societies, AFMS Cental Office, P.O. Box 302, Glyndon, MD 21071-0302, (410) 833-7926, http://www.amfed.org/ , central_office@amfed.org

Rocky Mountain Federation of Mineralogical Societies, http://www.amfed.org/, webmaster@rmfms.org

Photomat

Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____
Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____

Move it!

Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by the soil.

Objective 2:

Explain how the processes of weathering and erosion change and move materials that become soil.

Intended Learning Outcomes:

1. Observe simple objects and patterns and report their observations
2. Compare things and events.
3. Conduct a simple investigation when given directions

Content Connections:

Social Studies VI-1; Identify physical features of Utah

Science Standard III

Objective 2

Connections

Background Information

When water, wind and ice move rock, soil or another material it is called erosion. Erosion is the mover and weathering is the breaker. Helping students understand the differences between erosion and weathering is important.

The three simplest causes of erosion are wind, water, and glaciers. Wind carries away loose bits of soil and rock, particularly in dry areas with no plants to cover and protect the land. Water can erode in several different ways. Flowing water carries soil and rock particles down streams, rivers and into lakes and oceans. Ocean waves pounding the shore and ocean currents can also carry particles away. Finally, glaciers, massive slow moving rivers of ice, gouge the land beneath them and scrape away particles and rocks away.

The scientific investigations in this activity will demonstrate three different types of erosion. They can either be presented as individual whole class investigations or as centers with small rotating groups. Four plastic boxes will be used: the stream and wave box will demonstrate water erosion, and the wind and glacier boxes will represent their respective types of erosion.

The following activities will allow the students to simulate the four types of erosion listed above. Students will follow the directions on task cards at each station and record their observations in their student journals.

Materials

- ❑ Toy dump truck
- ❑ Toy hammer
- ❑ Hard hats
- ❑ Cookies
- ❑ *What Happens to Rock*
- ❑ Plastic boxes
- ❑ Block of wood
- ❑ Water
- ❑ Play sand
- ❑ Flexi-straws
- ❑ Cornstarch
- ❑ Small pebbles
- ❑ Overhead grid
- ❑ Cotton twine
- ❑ Diatomaceous earth
- ❑ Condiment bottle
- ❑ Sprayer bottle
- ❑ Washers
- ❑ Nut
- ❑ Student journals
- ❑ Goggles
- ❑ Lab Cards
- ❑ Clothes hanger
- ❑ Overhead marker
- ❑ Bowl scraper
- ❑ Pipettes

Research Basis

Chesbro, R., (2006). Using Interactive Science Notebooks for Inquiry-Based Science. *Science Scope*. 29(3) 30-34.

The interactive science notebook is an opportunity for students to create and use a notebook that represents their science learning throughout the year. Interactive science notebooks enhance learning by encouraging students to write across the curriculum and promote personal connections to learning.

Klentschy, M., (2005). Science Notebook Essentials. *Science & Children*.

This article focuses on the effective components of student science notebooks and their use as an effective teaching tool to assist students in developing a deeper *understanding of science content*.

Invitation to Learn

Two volunteers will act out a skit that illustrates the differences between weathering and erosion. Each actor will wear a hard hat labeled with "Weathering" or "Erosion." Different types of cookies representing the different types of rocks—sandwich cookies to represent sedimentary rocks, gingersnaps to represent metamorphic rocks and chocolate chip cookies to represent igneous rocks—will be used to illustrate how the rocks are broken up and transported away. A toy dump truck will represent erosion and a toy hammer will represent weathering. Write the analogy "Weathering is to a hammer as erosion is to a dump truck."

Read to the students from the book *What Happens to Rock*. Emphasize throughout the reading that weathering is the breaking action of rocks and erosion is the moving action of the particles.

Instructional Procedures

Prepare Erosion Boxes

- **Wave Box –** Place 4 cups of play sand at one end of a plastic box. Prop up that end of the box approximately 2 to 3 cm with a book or some other stable object. Use a piece of wood 26cm x 13cm x 1cm and place it at the opposite end of the box from the sand. Pour water into the box until it touches the sand (see diagram). Reproduce lab card.
- **Stream Box –** Prop up one end of a plastic box approximately 4-5 cm with a stable object. Carefully pour diatomaceous earth into the box. (Diatomaceous earth is a fine-grained powder that

is used in swimming pool filters. Even though it may look soft like flour, it is actually very abrasive and eye protection should be used when in close contact with it.) Thread the cotton string through the nozzle of the condiment lid and tie the nut to the string so the nut will be inside of the bottle if the lid is attached. Next tie the washer to the other end of the string. Using a bent hanger, suspend the condiment bottle over the high end of the inclined box so the string end with the washer touches the bottom of the box and is covered by the diatomaceous earth. Use the sprayer bottle and wet down the diatomaceous earth until it is damp. Fill the condiment squirt bottle with water and replace the lid. Place it in the hanger support and let the water drizzle down the string and into the diatomaceous earth. Continue adding water to the condiment bottle as needed.

Wave Box

- **Glacier Box –** Duplicate the centimeter grid onto an overhead transparency and tape it to the outside bottom of the box. Pour the 16-oz box of cornstarch into a container and add water slowly until it is the consistency of toothpaste. Be careful that the mixture is not too runny. Raise one end of the box between 2 to 4 cm. Have bowl scraper and glass pebbles on hand for the students.
- **Wind Box –** Place the rocks inside the last plastic box. Pour sand over the top of the rocks so they are completely covered (there should be 3-4 inches of sand in the box. Have the bendy straws available for student use.

Stream Box

Erosion stations

Group the students so that 3 to 4 of them will be at a station at a time. Explain that they will need to follow the Investigation Procedure listed on the card and then discuss with their small group the Investigation Questions on the opposite side of the card. Have them complete the required questions, and if time permits, the optional questions.

Assessment Suggestions

- Teacher observation of activity and discussion.
- Journal Entry using a rubric you and your students have made or the *Take a Tumble Journal Rubric*.

Curriculum Extensions/Adaptations/ Integration

- If more small groups are needed, you can use the "Rock Stars" and "Earth Mover" articles listed in the additional resources. These readings can offer a non-hands-on inquiry opportunity.

Additional Resources

Books

Sand, by Ellen J. Prager; ISBN 0-7922-7104-1

Kids Discover: Glaciers, by Stella Sands; ISSN 1054-2868

What Happens to Rock big book by Fred & Jeanne Biddulph; ISBN 0-7802-2794-8

Articles

"Rock Stars", by Beth Geiger. *National Geographic Explorer*, National Geographic Society; Vol 7, No. 5, March 2008; pp. 10-17; ISSN 1541-3357

"Earth Movers", by Lesley J. MacDonald. *National Geographic Explorer,* National Geographic Society; Vol 6, No. 2, Oct 2006, pp. 18-23; ISSN 1541-3357

Web sites

http://magma.nationalgeographic.com/ngexplorer/0501/quickflicks/

http://topsoil.nserl.purdue.edu/nserlweb/weppmain/overview/ersn.html

http://www.newtonsapple.tv/TeacherGuide.php?id=1657

https://imrcms.nps.gov/brca/forteachers/earthsystemactivity12.htm

http://3dparks.wr.usgs.gov/

Organizations

Minerals Management Service, 1849 C Street, NW Washington, D.C. 20240, http://www.mms.gov/mmshome.htm , gary.strasburg@mms.gov

Wave Box Investigation Procedure

Description: For this investigation you will be simulating erosion caused by waves. Carefully drain the water from the box. Use the bowl scraper to move the sand to one end of the box. Place the two rocks somehwere on the sand. Raise one level of the box between 2-4 cm. Put the piece of wood in the box and pour in enough water to reach the sand.

Predictions: Make a written predictions in your journal about what you think you will observe and what you think will happen.

Procedure

1. Tilt the box and use the bowl scraper to move the sand to one end of the box.
2. Raise one end of the box the box between 2-4 cm and place it on a stable support.
3. Insert the board in the box and add enough water so that it touches the sand
4. Have a member of the group keep track of time.
5. Have a member of you group simulate waves by tipping the board at regular smooth movements.
6. Observe what happens as the waves wash across the sand.
7. Follow the discussion guidelines on the other side of this card.

Stream Box Investigation Procedure

Description: For this investigation you will be simulating a stream using diatomaceous earth. Diatomaceous earth can cause eye irritation, so each make sure to wear goggles and avoid touching the white powder.

Predictions: Make written predictions in your journal about what you think you will observe as to what will happen.

Procedure

1. Put on goggles.
2. Make sure the condiment bottle is filled with water. If you need to fill the bottle, unscrew the lid and leave it at the box, fille the bottle and screw the lid back on.
3. Place the bottle into the holder.
4. Observe what happens as the water dribbles down the string.
5. Have a member of the group keep track of time.
6. Observe what happens to the simulated stream after 5 minutes.
8. Follow the discussion guidelines on the other side of this card.

Wave Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Could you make some generalizations about the movement of the different sand particles?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Did the profile of the sand take a specific shape.

Stream Box Investigation Questions

Stream Box Investigation Questions Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Could you make some generalizations about the stream shape?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?

Glacier Box Investigation Procedure

Description: For this investigation you will be using a mixture of cornstarch and water. This mixture has some interesting properties that will allow us to simulate an actual glacier. Glaciers, though slow moving, can move large quantities of rock material; some very small and others very large. It is OK to touch the cornstarch mixture, but be sure to let it flow naturally.

Predictions: Make written predictions in your journal about what you think you will observe and what you think will happen.

Procedure:

1. Tilt the box and use the bowl scraper to move the cornstarch mixture to one end of the box.
2. Lay the box flat and place the colored stones at different places on the box near the cornstarch.
3. Have one of the members of your group carefully pick up the box while another member of your group uses the overhead marker to draw a circle for each location of the colored rocks on the overhead transparency taped to the bottom of the box.
4. Raise one end of the box the box between 2-4 cm and place it on a stable support.
5. Have a member of the group keep track of time.
6. Observe what happens to the simulated glacier.
7. After 5 minutes, pick up the box and mark the ending location of the colored rocks.
8. Remove the overhead transparency.
9. Follow the discussion guidelines on the other side of this card.

Wind Box Investigation Procedure

Description: For this investigation you will be simulating wind erosion. You will use a bendy drinking straw, but instead of sucking through the straw you will blow through it. In addition, you wont be putting your mouth near the bendy end of the straw. You will place your mouth at the end furthest from the bendy part. This will let you simulate wind blowing across the sand rather than down on it.

Predictions: Make written predictions in your journal about what you think you will observe about what you think will happen.

Procedure:

1. Put on goggles.
2. Have a member of the group keep track of time.
3. Blow across the sand with your straw.
4. Observe what happens.
5. Stop after 5 minutes.
6. Throw away your straw so someone else won't use it.
7. Follow the discussion guidelines on the other side of this card.

Glacier Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Did all the colored stones move at the same rate?
- Could you make some generalizations about the movement of the colored rocks?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you had observed.

Extension: If you have time, choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Could you calculate the rate at which the rock moved? Were there some rocks that moved faster than others? Why do you think this happened?

Wind Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Did all the colored stones move at the same rate?
- Could you make some generalizations about movement of the sand?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Could you calculate the rate at which the rock moved? Were there some rocks that moved faster than others? Why do you think this happened?

Name _____ Date _____

Take a Tumble Journal Rubric

	4	3	2	1
Measurements	Includes mass, width, length, and volume measurements.	Is missing one measurement.	Is missing two measurements	Is missing more than two measurements.
Visual Description	Includes specific visual characteristics of shape, color, and identifying marks. Uses complete sentences.	Includes specific visual characteristics of two of the three categories. Most sentences are complete.	Includes general visual characteristics of two or more categories. Some sentences are complete.	Includes visual description of one characteristic. Most sentences are fragments.
Predictions/ Observations	Includes a specific prediction of how the rock will change, and a specific observation of the actual changes.	One prediction/ observation is specific. The other is general.	Both the prediction of change and the observation of change is general.	Includes either a prediction or an observation of change but not both.

Math II-2

Activities

Order of Operations

Socks and Shoes

Standard II:

Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 2:

Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notations of mathematics.

Content Connections:

Language Arts IV-1; Communicating, listening, & speaking
Language Arts IV-8; Communicate effectively for a variety of purposes

Math Standard II

Objective 2

Connections

Background Information

Before beginning this lesson, teachers must have a sound understanding of why the process of order of operations is important in math and how to correctly perform it. Order of operations is important in math because it helps assure us that math works the same way for everyone, regardless if they are students in Utah or professors in Japan. Through this understanding; we can safely say that an addition or multiplication problem solved correctly will always result in the same answer. As educators we need to help our students understand that they will always get the right answer if they follow the process correctly.

A common misconception is that multiplication must be performed before division. When we use the mnemonic Please Excuse My Dear Aunt Sally, it is often assumed that because we say My (multiplication) before Dear (division) that we need to multiply first. However, multiplication and division are on the same level and should be performed based on their position in the order of operations problem. This same principle applies with addition and subtraction. The correct order of operations starts with working in parentheses, then looking for exponents, and then returning to the left or beginning of the equation and working your way towards the right as you solve. Once you have performed the multiplication or division steps, you return the beginning of the problem and work your way left to right, performing

addition or subtraction in the proper order. This will allow you to answer the problem correctly.

For these activities, we are going to focus on order of operations problems that deal with addition, subtraction, multiplication, and division. Students need to be familiar with basic multiplication and division facts and need to be taught about parentheses. Exponents are not found in the Utah State Math core until the 5th grade and so we are not going to be working with problems that have exponents in them.

Research Basis

Millis, B.J. (2002). Enhancing learning-and more! through cooperative learning. Idea Paper # 38. The Idea Center, 211 South Seth Child Road Manhattan.

In this article, Millis explains the power and effectiveness of cooperative learning. Not only is cooperative learning an effective teaching strategy, it "promotes a shared sense of community" in the classroom because "learning, like living, is inherently social." As students learn to work together through cooperative learning, they develop trust with each other and are given an opportunity to develop self-efficacy. As teachers come to understand how to implement cooperative learning, "student learning can be deepened, students will enjoy attending classes, and they will come to respect and value the contributions of their fellow classmates."

Willis, J. (2007). Cooperative learning is a brain turn-on. *Middle School Journal*. March pgs. 4-13

Judy Willis states in her article that research has shown that "in math collaboration, students learn to test one another's conjectures and identify valid or invalid solutions." This happens because cooperative learning provides students with the most opportunities to ask questions, express ideas and opinions, and come to conclusions that they might not otherwise have through whole group instruction. Teachers can increase student understanding and involvement by increasing the amount of cooperative learning in their classrooms.

Invitation to Learn

The most commonly used mnemonic for order of operations is Please Excuse My Dear Aunt Sally. Instead of teaching this mnemonic to the class, the purpose of this invitation to learn is to help students develop ownership for their learning as they work together to develop a unique classroom mnemonic of their own liking.

The first step in this process is to say, "Today we are going to create a mnemonic that is going to help us as we learn about order

Materials

- ❑ Math Journals
- ❑ Pencils

of operations. Does anyone know what a mnemonic is? A mnemonic is a phrase or saying that makes information easier to remember. Has anyone ever heard of "righty-tighty, lefty-loosey"? How about "Every Good Boy Does Fine"? These are mnemonics that help us remember how to tighten or loosen a bolt and the order of musical notes on a treble staff. Using these mnemonics makes it easier to remember these things."

Go to the board and write order of operations at the top of the board. Explain that there are five steps in solving order of operation problems. (Don't worry about explaining the steps in detail. We will do that in greater detail later.) As you introduce the steps, write the steps on the board. The steps are Parentheses, Multiplication, Division, Addition, and Subtraction. Remember that our students are not going to be using exponents in 4th grade and so we do not need to include exponents in our mnemonic.

Next say, "Now we need to come up with a mnemonic phrase that will help us remember the steps when solving order of operations problems. Do you remember what a mnemonic phrase is? It is a phrase or saying that helps us remember. The most common mnemonic for order of operations is Pardon My Dear Aunt Sally (The mnemonic changes when the E for exponents is taken out), but that's no fun. Let's come up with a fun mnemonic. For example, we could say "Pink Monkeys Dance Around Santa" or "Pretty Muffins Dream About Snickerdoodles."

The next step can be done either as a whole class process or as a think-pair-share activity. We will focus on the think-pair-share activity because it gives every student an opportunity to participate. Begin by saying, "We are going to do this by doing a think-pair-share. First, you are going to use your math journals and write down a fun mnemonic phrase. Then, you are going to share your mnemonic phrase with your neighbor."

While the students are thinking and sharing, go around the room and put the class into groups of six. Then say, "Now that you have had a chance to share with your neighbor, you are going to get into your groups and share again. When you have all had a chance to share, you need to pick one mnemonic phrase from your group that you feel would be the most successful as our class saying."

When the students have decided, have each group share the mnemonic phrase. Write each mnemonic on the board and then have the class vote on which mnemonic phrase they would like to use. Once the mnemonic phrase is decided, have the students write down the phrase in their math journals.

Instructional Procedures

Socks and Shoes

Materials

- ❑ Socks
- ❑ Shoes
- ❑ Math journals
- ❑ Pencils

The purpose of this activity is to bring students' background knowledge into the lesson and to allow them to see how order of operation applies to nearly everything they do during the day.

1. Divide the class into 4-6 groups. Students need to bring their math journals and a pencil to their group. You are going to need 1 sock and 1 shoe for every group. For health reasons do not use student socks or shoes.
2. Begin by saying, "I am going to be passing out two objects to every group. Before you do anything with these two objects, I want each group to discuss how these two objects relate to each other." Pass out 1 sock and 1 shoe to each group. Give them 2 or 3 minutes to discuss how a sock and shoe relate to each other.
3. Once you have done this, have each group share their ideas with the rest of the class.
4. Say, "Now that we have talked about how a sock and shoe relate to each other, I want you discuss the correct way of putting on a sock and shoe. Come up with a series of steps that you need to follow to do it correctly. When you think you have the correct way, write the steps down in your math journals. Be ready to share your ideas." Give the students 5 minutes to write down their steps.
5. When they are done, have each group share their steps. Compare the order of steps from each group and come up with a class list of the proper and correct manner of putting on your socks and shoes.
6. Now ask, "Why is important that you have steps as you put on your socks and shoes? What would happen if you didn't follow the steps correctly?" Call on some students to share their ideas, and then say, "Now for some fun. I am going to give every group 5 minutes to come up with as many creative ways to use your sock and shoe without using them correct way or following the steps. Write down your ideas in your math journal. Remember, have some fun and be creative." Don't be afraid of silly or goofy answers because this is what you are looking for.

7. As your students finish their lists, say, "I need you to choose your top three ways that your group thinks no one else has thought of, and label them 1, 2, and 3." Let them choose.
8. Say, "Now that you have come up with your top three ways, we are going to make a class list." As each group shares, write their answers on the board. Make sure that the students share their fun answers.
9. Once you have the list on the board, ask the class, "What do you notice about the ideas on the board?" Guide the students in their answers and help them understand that even though the ideas on the board might be funny, they are all wrong and that if we don't use socks and shoes properly, they "don't do what they are supposed to."
10. Then ask the class, "What other things do you do throughout the day that need to be done in a certain order?" Possible answers could range from brushing your teeth, getting dressed, eating breakfast or lunch, to even doing homework. Discuss what could happen if you stopped doing those things in the right order. Help the students understand that order is very important in everything that they do.
11. End this activity by saying, "Now that we have talked about order of operations and why we need to do things in order, you are going to write an entry in your math journal about why order of operations is important to you." If you want, you can have the students label their math journal entry "Why Order of Operations is Important to Me" or you can have them write their own title. Have the students turn in their journal when they are done to check for understanding.

Assessment Suggestions

- Use the students' journals to assess their journal entry on "Why Order of Operations is Important to Me".
- Listen and monitor group discussion on order of operations.
- Make sure that students don't start wearing socks over their shoes.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners may design a science experiment that needs to follow a certain order of steps. They could demonstrate

the results of doing it incorrectly (not following the steps in order) and then show what happens when the correct steps are followed.

- This activity may be adapted by having students act out or model the proper way of doing things instead of writing the steps down.
- This activity can be integrated into writing by having students write a story about what the world would look like if things were done out of order.
- Teachers may use previously learned math concepts to demonstrate wheat happens when math problems are done out of order.

Family Connections

- Students can discuss order of operations with their parents.
- Students can come up with a list of activities that they do everyday as a family that are done in a certain order. Then they can come up with ideas of what would happen if the family started doing things differently.

Additional Resources

Web sites

http://www.mathgoodies.com/lessons/vol7/order_operations.html

http://www.dositey.com/math/m/mystery2SMA.htm Solve the equations to reveal the picture.

http://www.tki.org.nz/r/wick_ed/maths/interactives_matho2.php Online game called Matho.

http://cemc2.math.uwaterloo.ca/mathfrog/english/kidz/order.shtml Timed order of operation problems.

http://www.funbrain.com/cgi-bin/alg.cgi?A1=s&A2=3 Basic order of operations practice.

Property Posters

Standard II:

Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 2:

Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notations of mathematics.

Content Connections:

Language Arts IV-1; Communicating, listening, & speaking
Language Arts IV-8; Communicate effectively for a variety of purposes

Math Standard II

Objective 2

Connections

Background Information

The most important background information for this activity is that teachers need to be familiar with the commutative and associative properties of addition and multiplication. They also need to be familiar with the zero and identity properties of multiplication and know how to teach these properties to their students.

The associative property teaches us that two numbers added or multiplied together can be added or multiplied in either order and that they will come up with the same answer. For example, we see that 3 + 6 = 6 + 3 and 3 x 6 = 6 x 3. The commutative property teaches us the same thing but deals with 3 or more numbers. For example, we can see that 3 + 6 + 2 = 2 + 3 + 6 and 3 x 6 x 2 = 2 x 3 x 6. The identity property teaches us that any number multiplied by 1 will always equal that same number. Finally, the zero property of multiplication teaches us that any number multiplied by 0 will always equal 0.

Research Basis

Millis, B.J. (2002). Enhancing learning-and more! through cooperative learning. Idea Paper # 38. The Idea Center, 211 South Seth Child Road Manhattan.

In this article, Millis explains the power and effectiveness of cooperative learning. Not only is cooperative learning an effective teaching strategy, it "promotes a shared sense of community" in the classroom because "learning, like living, is inherently social." As

students learn to work together through cooperative learning, they develop trust with each other and are given an opportunity to develop self-efficacy. As teachers come to understand how to implement cooperative learning, "student learning can be deepened, students will enjoy attending classes, and they will come to respect and value the contributions of their fellow classmates."

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Invitation to Learn

Materials

- ❑ Examples of different types of posters (movie, educational, motivational, sport, or quick reference)
- ❑ Math journals

The purpose of this invitation to learn is to help students understand that posters are used for a variety of reasons, many of which focus on advertising, communication, and information. Before beginning this activity, place a variety of posters around the room. Most classrooms already have posters hanging in them but for this activity try and hang some new or different posters that are new to the students.

Begin by saying, "As you may have noticed, I have hung some different posters around the room. I want you to take a few minutes, wander around the room, and look at the posters. As you wander, I want you think about the questions I am going to write on the board." Write the following questions on the board: Why do we have posters (what do posters do)? Are there different types of posters? Which ones do you like the best?

Then say, "The questions I want you to think about are: Why do we have posters (what do posters do)? Are there different types of posters? And which ones do you like the best? After you have wandered around the room, I want you to take a minute or two and write down your thoughts in your math journals." Give the students two or three minutes to look at the posters before sending them back to their desks to write in their journals.

After the students have written in their math journals, start with question one and say, "Let's talk about why we have posters. Does anyone have any ideas about why we have posters?" Let the students

share their ideas. Help them come to the understanding that posters are used to advertise things, communicate ideas, entertain, and share information.

Then ask, "How many of you think that there are different types of posters? Do we have different types of posters in our classroom?" Call on different students to point at different posters throughout the room. As you point them out, compare different posters, finding similarities and differences.

End this invitation to learn by discussing the third question. Say, "So, which posters did you like the best?" As you call on students to share, follow up this question with the famous "Why?" It is important that students explain why they like the posters. This will help them as they design their own posters in the next activity.

Instructional Procedures

Materials

- ❑ Poster Paper
- ❑ Crayons
- ❑ Math Journals

This activity is going to focus on helping students remember the commutative, associative, distributive, and identity properties of addition and multiplication by having the students create posters that they will hang around the school or classroom. However, this activity is not going to focus on teaching the properties. If the students haven't written these properties down in their math journals yet, have them write them down as you review.

1. Begin this activity by dividing your class into groups of 4-6 students. Start by saying, "Today we are going to be reviewing the properties of addition and multiplication. When we are done, we are going to make posters that we can place around the room or school to help us remember them."
2. Go to the board and write Properties of Addition and Multiplication. Say, "There are four properties that we are going to include on our posters. I am going to model and review the properties first, and then you will get into your groups and design a poster that demonstrates each property."
3. Next say, "We are going to start with the commutative property. The Commutative property teaches us that when we add or multiply two numbers, we can add or multiply them in any order."
4. Write 2 + 4 and 2 x 4 on the board. Start with 2 + 4 and say, "Let's look at 2 + 4. When we add 2 and 4 together, what do we get? 6." Now ask, "What happens when I switch the 4 and 2 and write 4 + 2? What answer do we get? Do we get the same answer? Yes, we do. Now I want you to take a few seconds

in your group and discuss why we get the same answer. Get ready to share your answers." Give the students some time to discuss. Have them share their answers when they are done. As the students share their answers, emphasize the fact that it doesn't matter what order you add because you will get the same answer.

5. Repeat this same process using 2 x 4 to review for multiplication.
6. Then say, "The next property we are going to review is the associative property. The associative property is similar to the commutative property except it uses three or more numbers." Write 2 + 4 + 3 and 2 x 4 x 3 on the board and then say, "Let's start with 2 + 4 + 3. We can use parentheses to help us add when we have more numbers." Place parentheses around the 2 + 4 so that it looks like (2 + 4) + 3. Most problems already have the parentheses around them when they have three or more numbers but it is important to help students understand that they can use parentheses to help them out.
7. Say, "Remember, when using order of operations we always do what is in parentheses first. What two numbers are in the parentheses? 2 + 4. Let's add those together. What do we get? 6. Good." Write the 6 below (2 + 4). Then say, "Now that we have added 2 and 4, we need to add 3 to our answer. Let's add 6 + 3. What do we get? 9."
8. Now say, "Let's try this problem again, but this time we'll move the parentheses and place them around the 4 and 3." Place parentheses around the 4 + 3 so that the problem now looks like 2 + (4 + 3). Ask the class, "What's the rule about parentheses? Good, we need to do the problem in the parentheses first. Let's add 4 + 3. What answer do we get? 7." Write the 7 below the (4 + 3).
9. Now ask the class, "What do we do now?" Wait for the appropriate answer and then say, "That's right, we need to add 2 + 7. What do we get? 9. Did we get the same answer? We did, didn't we? Just like the Commutative property, the Associative property teaches us that it doesn't matter the order in which we add three or more numbers because we will get the same answer."
10. Repeat this same exercise with 2 x 4 x 3 to review the associative property for multiplication.

11. Next say, "Now that we have discussed the associative and commutative properties, we have two more properties that we need to talk about. These are the Identity and Zero properties of multiplication." Write 6 x 1 = ? on the board and ask, "What do we get when we multiply 6 x 1?" Wait for the students to answer. Do this a few more times with different numbers multiplied by 1. When you have done this, ask the class, "What do you notice about these problems?" Lead the discussion towards the fact that any number multiplied by 1 will equal that same number. End by saying, "This is what the Identity property teaches us. Any number multiplied by 1 equals that same number."
12. "Let's finish our review by talking about the Zero property of multiplication." Write 6 x 0 = ? on the board and then ask, "Does anyone know what happens when we multiply 6 by 0? What answer do we get? Zero, that's right. What would happen if I multiplied 1,000 by 0? What answer would we get? Zero again. What about 1,000,000 x 0? Do we get zero again? We do. This is what the Zero property of multiplication teaches us. Any number multiplied by zero, no matter how big or small, will always equal zero."
13. Now say, "Now that we have reviewed the properties of addition and multiplication, I am going to pass out a piece of poster board and markers (crayons or colored pencils) to each group. On your poster, you are going to define and give examples of each property. You can decorate the poster however you like, but make sure that it is your best penmanship and artwork. You can also use your math books and math journals to help you define the properties. If you are not sure about the wording of your definition, raise your hand for clarification."
14. Pass out the poster paper, and markers (crayons or colored pencils), and allow the students to work on their posters. As students work, it is important that the teacher monitors the definitions that the students are writing.
15. When students are finished with their posters, allow them to present the posters to the class and then let them decide where they would like to hang them.

Assessment Suggestions

- Use the student posters to assess student understanding of addition and multiplication properties.

- Students may develop their own property problems.
- Students can conduct a survey of other classes to see if the posters helped them remember the properties.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners may study the history of posters and then write a paper explaining what they found.
- Learners with special needs may work cooperatively with regular education students.
- Instead of creating posters, students may develop an alternative media source (TV commercials, postcards, radio ads) that explain the properties.
- The associative, commutative, identity, and zero properties can be used as spelling words.

Family Connections

- Students may create their own posters for their rooms or homes.
- Students may create a "family" poster to share with the class.

Order of Operations Treasure Hunt

Standard II:

Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 2:

Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notations of mathematics.

Content Connections:

Language Arts IV-1; Communicating, listening, & speaking
Language Arts IV-8; Communicate effectively for a variety of purposes

Math Standard II

Objective 2

Connections

Background Information

The purpose of this activity is to give students the opportunity to use order of operations equations in a fun, engaging environment. During this activity, students will have the opportunity to work collaboratively as they create a treasure map and clues that are based on order of operation equations of their own design. Due to the nature of this activity, you may want to have some parents or other volunteers assist you. This activity may be done in one day or it may be broken up over a few days, whatever is most efficient for the teacher.

Before teaching this lesson, students must be familiar with the correct order of steps when performing order of operation problems. For these activities, we are going to focus on creating order of operations problems that deal with addition, subtraction, multiplication, and division. Students need to be familiar with basic multiplication and division facts and need to be taught how to use parentheses in order of operations equations.

This activity is going to require students to work in a small group setting. If students haven't had many experiences working in small groups, take the time to establish expectations about proper behavior. Many teachers like to assign group responsibilities such as group leader, scribe, material manager, and so forth when working in small groups. In this activity, the students are going to have the roles of *Map Maker, Interpreter, Guide, and Captain*. The *Map Maker* will be responsible for drawing the treasure map, the *Interpreter* will write

down the clues, the *Guide* will be responsible for getting materials, and the *Captain* will be responsible for keeping the group on task. This will give each student the opportunity to actively participate in the group.

As I tried this activity in my classroom, I found that students wanted to use a lot of numbers for each problem. The students need to start with simple problems that deal with addition or subtraction and then work their way towards more difficult problems that include parentheses, multiplication, and division. I would limit the amount of numbers for each problem to less than 6 numbers for the more difficult problems.

Research Basis

Millis, B.J. (2002). Enhancing learning-and more! through cooperative learning. Idea Paper # 38. The Idea Center, 211 South Seth Child Road Manhattan.

In this article, Millis explains the power and effectiveness of cooperative learning. Not only is cooperative learning an effective teaching strategy, it "promotes a shared sense of community" in the classroom because "learning, like living, is inherently social." As students learn to work together through cooperative learning, they develop trust with each other and are given an opportunity to develop self-efficacy. As teachers come to understand how to implement cooperative learning, "student learning can be deepened, students will enjoy attending classes, and they will come to respect and value the contributions of their fellow classmates."

Willis, J. (2007). Cooperative learning is a brain turn-on. *Middle School Journal*. March pgs. 4-13

Judy Willis states in her article that research has shown that "in math collaboration, students learn to test one another's conjectures and identify valid or invalid solutions." This happens because cooperative learning provides students with the most opportunities to ask questions, express ideas and opinions, and come to conclusions that they might not otherwise have through whole group instruction. Teachers can increase student understanding and involvement by increasing the amount of cooperative learning in their classrooms.

Invitation to Learn

Materials

- ❑ Math Journals

This invitation to learn is simple. Ask the students what they would do if they found hidden treasure. What would they buy, where would they go, or who would they help? Have them write their answers in their math journals. Discuss their answers as a class.

Instructional Procedures

1. Before starting this activity, draw a simple map of your room on the board. Label important features such as the door, windows, teacher's desk, and whiteboards. Then hide something in your room (it could be anything) and come up with a series of clues or steps that the students need to follow in order to find the object. These clues should focus on students doing things a certain number of times, such as "take 4 steps towards the front of the room" or "spin around 2 times and face the windows." Write the clues on the board next to the map but instead of writing "Take 5 paces north" write "Take (4 x 3) + 2 – 9 paces north". For your first three clues, come up with order of operations problems that tell how many times the students need to do something. On the rest of your clues, leave a blank space where the order of operations should go. The class will work in groups of 4 to create their own order of operation problems that equal the number in each clue.
2. Begin this activity by placing the treasure chest in front of the class. Ask the students, "Does anyone know what this is?" Allow the students to answer and then ask, "Who can tell me what a treasure box is?" or "What do you find inside of a treasure chest?"
3. Continue the class discussion by asking, "Where do you find a treasure chest? Are they easy to find?" Allow the class to continue answering and then ask, if it hasn't already been brought up, "What do you usually need in order to find a treasure chest? That's right. You need a treasure map." Hold up the treasure map so that your students can see it.
4. Then ask, "Do you need anything else besides a treasure map? What kind of tools and clues would make finding the treasure chest easier?"
5. Then explain, "Today we are going to go on a quick treasure hunt. However, instead of using the treasure map in my hands, we are going to use the map I have drawn on the board." Pointing at the map and clues on the board say, "This is a map of our classroom. I have hidden "treasure" somewhere in our room and we need to use the map and clues in order to find it."
6. Divide your class into groups of 4 and assign each group member one of the following roles: Map Maker, Interpreter,

Materials

- ❏ Construction paper
- ❏ Crayons
- ❏ "Treasure"
- ❏ *Order of Operations Compass*
- ❏ Treasure Chest
- ❏ Treasure Map
- ❏ Lined paper
- ❏ Pencils
- ❏ Parents/Volunteers

Guide and Captain. Give them a few minutes to decide a team name.

7. Point at the board and say, "The treasure is hidden somewhere in our room. Let's look at our first clue to see if it can help us." Read the first clue to the class and then ask, "How is this clue different from regular clues?" Help the students understand that the order of operation problems need to be solved before we can do what the clue tells us.
8. Take this time to review the class mnemonic that you have developed and to pass out a piece of lined paper and the order of operations compass.
9. Have the students solve the order of operation problem as a group and then choose one student from the class to follow and do what the clues say to do as the class solves them.
10. Repeat this process for the next two clues.
11. For your next clue say, "Notice that the next clue does not have an order of operations problem or number listed. For the next few clues, I am going to give you the number and you are going to have to create your own order of operation problem that equals that number."
12. Start the students out with simple problems that deal with addition and subtraction. Give the students time to work on their problems and then have them trade problems with a different group.
13. Repeat this same process with the rest of your clues until the student finds your hidden "treasure". Allow the students to use multiplication and division to make the clues more difficult.
14. Once you feel that the students are capable of writing order of operation problems, they can start on their own treasure maps and clues.
15. As students are deciding where to hide their treasure, the students should choose places that are not in classrooms or in locations that will disturb other teachers or students. (If you decide to do this activity in your school, talk to your school administrator and inform him/her what is going to be happening.)
16. Say, "I am going to give you 5 minutes to decide where you would like to hide your treasure. Captains make sure that your group is back on time. Once you have decided, come back to the classroom. As you come back into the classroom, the

Guides will get two pieces of lined paper, one for your treasure map and the other for your clues."

17. When all of the students have found their spots, the next step is to develop their clues and maps. Begin this process by saying, "Now that you have found your spots, we now need to come up with clues that will lead us to the treasure. Interpreters are going to write the clues on one piece and Map Makers are going to draw a rough draft of the treasure map on the other."
18. "Your clues should be simple but fun. You can hop, skip, walk backwards, pace, and even army crawl towards the treasure. For example, as you go towards the treasure you could have a group 'Hop 5 times down the hall'."
19. "As the Interpreter is writing down your clues, the Map Maker needs to be drawing your treasure map. Make sure you label important places on the maps such as rooms, stairs, or playground equipment."
20. "Captains, you are responsible for taking care of your group. When you get done with your clues and treasure map, come back to the classroom. As you come into the classroom, Guides need to get a piece of tan construction paper to draw your map on."
21. When all of the students are back in the classroom and working on their maps, say, "Let's take a few minutes and talk about your clues. Remember that we are going to be developing order of operations problems for each clue. This will make each clue more difficult and fun to follow."
22. Then say, "Everybody look at your first clue. As a group, I want you to come up with an order of operations problem for your first clue. Remember to use your order of operation compasses and our classroom mnemonic to make sure that each problem is solved correctly. Raise your hands when you have created your first problem and I will come and check it."
23. Once you have checked the first clue say, "You are now going to create order of operation problems for each of your clues." Have the students turn their papers in when they are done.
24. Once the order of operation problems have been checked, pass them back to each group. The group will then write the clues on the back of their treasure maps.
25. When the students are finished with their maps and clues, have the group follow their own clues and map one more time. As

the students are trying it out, give the students "treasure" that they can hide.

26. The final part of this activity will be to trade the maps and clues with other groups. The students will need to have a piece of lined paper to solve the equations as they look for the treasure. The students will only get to keep the treasure if they show the other group their work and answers for each clue.
27. End this activity by having the students reflect on the following questions in their math journals. Write the following questions on the board. "What did you learn from this activity?" "What was the most difficult part of this activity?" "What was the most enjoyable part of this activity" "Did this activity help you understand order of operation problems? How?"

Assessment Suggestions

- Collect and read the students' math journals.
- As students are developing their order of operation problems, informally assess if they are doing them correctly.
- Listen to student discussion during cooperative learning.

Curriculum Extensions/Adaptations/ Integration

- Advanced learners can work with learners with special needs as student tutors.
- Order of operation clues can be made more difficult.
- This activity can be adapted to meet the needs of learners with special needs by simplifying the amount or difficulty of each clue.
- This activity can be integrated into writing as students write a fictional story about them finding a treasure map.
- Students can research the history of treasure maps.
- Find books and stories that deal with treasure maps.

Family Connections

- Students can make treasure maps of their room, yard, or home.
- Students can study maps with their parents and discuss how to read them correctly.
- Invite parents into the classroom to help with this activity.

Additional Resources

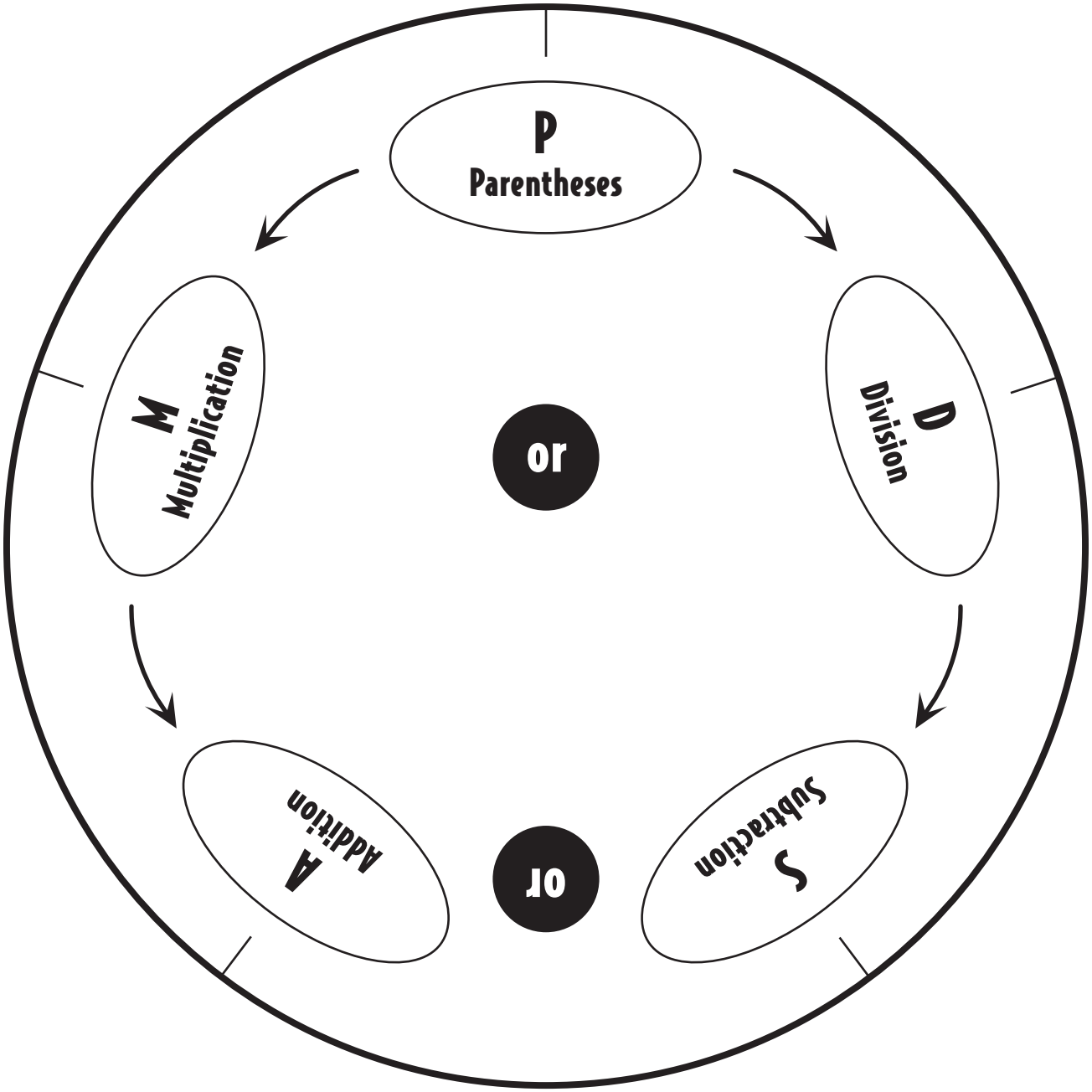
Books

Treasure Hunters- The Usborne Book of Treasure Hunting (Prospecting and Treasure Hunting), by Anna Claybourne, Caroline Young, Judy Tatchell, and Jenny Tyler; ISBN 0746034458

Treasure Map (MathStart 3), by Stuart J. Murphy; ISBN 0064467384

100 Puzzles, Clues, Maps, Tantalizing Tales, and Stories of Real Treasure, by Michael Stadther; ISBN 0976061813

Order of Operations Compass



Science V-3

Activities

Classification

Classifying Kids

Standard V:

Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 3:

Use a simple scheme to classify Utah plants and animals.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests

Content Connections:

Math III-1; Identify geometric shapes

Science Standard V

Objective 3

Connections

Background Information

This activity is meant to get students excited about grouping and classifying. Students need to get up and experience classifying to help them understand better how to use a classification key. This activity can be done with or without prior knowledge of sorting. It would help if students were familiar with the words *classification* and *grouping*.

Research Basis

Wolfe, P. (2001). Brain matters: translating research into classroom practice. Association for Supervision and Curriculum Development, Alexandria, VA.

The brain processes abstract information best after experiencing real things first and then symbolic representations. To analyze and compare information, the brain needs to be able to base it on an experience. When learning science, students need to be presented with real-life experiences and meaningful context that build a base for the abstract written problems we usually pose on tests.

Invitation to Learn

Take all of the students into a gym or a room with lines on the floor. (If neither are available create lines on your floor, use stairs, or find points of reference in your classroom.) Give each student a pattern block (but don't use the rhombus, the most narrow block) and explain that they need to follow your instructions based on what their block looks like. Use the following instructions to sort the students by their blocks.

1. If your block is a polygon, move to the first line.
2. If your block has at least 4 sides, move to the next line (this should leave those holding triangles standing on the first line).
3. If your block has 6 sides, move to the next line (this should group the hexagons together).
4. If your block has 4 right angles, move forward 2 lines (this will group the squares).
5. If your block has 4 equal sides and 2 acute angles, move forward 3 lines (this will leave the trapezoids alone)

Talk about how everyone moved at first, because they have one thing in common, but then found that they had differences. Discuss how the trapezoids, squares, and parallelograms were alike and different. Make sure to point out how the triangle is similar and different. After discussing, collect the shapes and return to class to begin the lesson. This activity will work with a variety of objects, but you should be able to get into groups in less than 6 steps or it will get too complicated.

Instructional Procedures

Materials

- ❑ Pattern blocks
- ❑ Student journals

1. Explain that classifying is a way to organize animals, plants, and objects. It helps to see how things are similar and different.
2. Talk about how everyone in the room is similar, yet different and we can put them into groups based on these similarities and differences. Give an example (Jenny and Penny are both girls but one has brown hair and the other blonde, so they could both go in the girl group but they could be separated into hair groups). Then allow students time to point out as many similarities and differences as they can.
3. Ask students to talk with their group about how they would group the class. Give them about 2 minutes to talk and then ask them to write their ideas into their journal. Students write the different groups they would use.
4. Guide the students through grouping the class. Allow students to volunteer the groups they thought of and have students get up and move into these groups. This allows students to see the groups and to clarify their thoughts. Divide the class into 3-5 groups. After finalizing the groups, have the students write these groups into their journal. Students should include the names of the students who fit into each of these groups for reference later.

5. Model how to write a classification key to describe the student groups. Use poster paper (plain or graph paper). Say each step e.g., 1. if you are a boy go to question 2a, if you are a girl go to question 4a.
6. After writing the classification key, show students how to use it to find each group.

Assessment Suggestions

- Have students copy the classification key into their journal and explain how to use it.
- Play guessing games. Use the clues on the classification key to guess different students around the room. Allow students to do both clue giving and guessing.
- In math, have students group numbers or objects and write about the groups.

Curriculum Extensions/Adaptations/ Integration

- A dichotomous key is easier to use at first. If students have a hard time following your model of a classification key, make a dichotomous key first. Then use the dichotomous key to write your classification key.
- Students that understand how to use the classification key can create a new key using the students in the room in different groups. They can present their key to their groups.
- Have students pull off a shoe, coat or backpack to use for grouping to repeat the activity if students are still struggling with the concept.

Family Connections

- Ask students to group their family the same way they grouped the class.
- Have students complete a survey or interview about how people use classification during their everyday lives. Create a bulletin board to show the other ways it is used in real life.

Keys and Classifying

Science Standard V

Objective 3

Standard V:

Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 3:

Use a simple scheme to classify Utah plants and animals.

Intended Learning Outcomes:

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

Content Connections:

Science V-3; Creating a classification key

Connections

Background Information

Classification is the scientific process of organizing organisms into logical groups. Students need to know that they can discover the identity of any organism by following classification schemes. These schemes focus on similarities and differences. Students need lots of experience classifying anything and everything. By providing lots of exposure in various ways you provide more opportunities to succeed. This activity is more beneficial if taught multiple times using various objects for classification.

Research Basis

Wolfe, P. (2001). Brain matters: translating research into classroom practice. *Association for Supervision and Curriculum Development,* Alexandria, VA.

Writing should be combined with other learning activities to provide different cognitive experiences. Having students write their results or procedures extends the scientific thinking, because writing is a more complex skill.

Marzano, R.J., Pickering, D.J., Pollock, J.E. (2001). Classroom instruction that works: Research-based strategies for increasing student achievement. *Association for Supervision and Curriculum Development*, Alexandria, VA.

Comparing, classifying, and identifying similarities and differences are effective instructional methods that encourage scientific thinking.

Invitation to Learn

Invite students to pretend that it's 2030 and we know aliens exist. Explain that 3 alien ships were fighting and they shot each other down. The remnants of the ship are in the desert and need to be cleaned up. The officers want to bury the bodies of the aliens with their ship,

but the aliens are scattered all over the place. The officials need your help to determine which aliens went with which ship. Pass out the *Alien Cards* and *Alien Organizer* to each group. Ask groups to cut out the pictures and put them in the column with the ship they traveled in. *The idea is for students to group aliens with the similar symbol into the ship with the same symbol.* After allowing time for groups to work, have them share their findings with another group and defend why they did it that way. Discuss how students determined the ship to put each alien.

Instructional Procedures

Materials

- ❏ *Alien Cards*
- ❏ *Alien Organizer*
- ❏ Sorting objects
- ❏ Students journals

1. Have students get out their science journals. Explain that they are going to do a Quick-Write. The purpose is for students to write for 2 minutes about classification, to get them thinking about the topic, drawing out any prior knowledge. Tell the students that you want them to write the whole time because sometimes we get more ideas as we write our current ideas down. Sometimes this means they will be writing about other things, but encourage them to keep it as close as they can to classification. This might take practice to keep them writing for 2 minutes (use writing time or do it every day before some lessons).
2. Explain that students are going to be learning about classification today.
3. Define classification as grouping objects according to similar characteristics. The purpose of classification is to provide a way to look at similar objects but know which is which through classification.
4. Model classification by taking a group of objects and sorting them.
   - Talk as you sort so students can hear your thinking.
   - Point out characteristics and similarities.
   - Name each group using the characteristics (make sure it relates to why those objects are in that group).
   - Defend the reason for making those groups.
5. Show students the other groups of objects and explain that they now have the chance to sort/group objects. Put the objects around the room and allow students to decide where they would like to work.

6. Explain that groups need to discuss and decide how to sort the objects. Then determine a name for each group of objects based on the characteristic for that group.
7. Allow groups time to work while you monitor and listen to their thinking. Make sure students are talking to each other. Ask questions where needed.
8. After sorting, ask groups to create a chart that shows the objects in each group and has a written defense for placing those objects together.
9. After all groups are completed, have a spokesman from each group travel to the other groups to share what they did. The spokesman moves in a clockwise motion and spends about 30 seconds at each group.
10. Model how to single out each object. If the group has more than one object, then they need to single each object by a difference. Show how each object is in the same group but a little different. Then give each object a name.
11. Allow each group time to single out and name each object.
12. Show students a classification key and explain that scientists use it to identify objects. Model how a classification key works. Show students how to read the characteristic and then look at the object to determine if it fits the characteristic. Then follow the directions on the key.
13. Model how to write a classification key for your objects. Make sure to focus on characteristics (if an object is round go to 2a, etc.).
14. Have groups create a classification key for their objects. Provide assistance and support as needed.

Assessment Suggestions

- Written assessment: Students must describe their groups and defend their reasons for making those groups.
- Performance and written assessment (can be done individually or as a group): Provide students with a new collection of objects, have them group them and create a classification key. (See rubric.)
- Use the Quick Write as a pre-assessment. At the end, ask students to answer the question again to see if understanding has changed, improved, deepened, etc.

- Have students create a classification key and then pass it on to a neighbor. The neighbor must use the classification key to identify the objects. To go even further, the neighbor could provide feedback on whether the key was helpful or if more work needed to be done.

Curriculum Extensions/Adaptations/ Integration

- Provide a center for students who finish early to continue with the same activities by grouping new objects and creating classification keys. They must have someone use their key successfully.
- For early finishers provide a classification key and an object. Students must identify their object using the key.
- If students are struggling, make sure they continue to work with a student who knows how to create the key successfully.
- If students are having trouble spelling or writing, allow them to record the instructions or script them to another person.
- Sort words by homophones, prefixes, suffixes, plurals, etc. Students group the words and identify similar characteristics.
- Show a group of numbers and have students sort them based on mathematical characteristics (try to avoid the shape or size of numbers). e.g. (2, 4, 5, 9, 12, 13, 20. 2, 4, 12, and 20) would be in the even group. (5 and 13) would be in the prime number group. (9) would be in the square number group. Students could also sort different types of fractions by congruency, less than ½ or larger than ½, etc.
- Give students different triangles to sort by angles, types, or sizes.
- After reading a story with lots of characters, have the students group the characters together.
- Group books/stories by genre, plot, setting, theme, etc.

Family Connections

- Ask students to classify something from their home. Pass out *Home Classification Sheet* to complete as they classify.
- Have students teach the alien classification activity to someone else in the family. A family member sorts the aliens, the

student write about what the family member did, and the family member signs off.

- Assign students to write a paragraph explaining what classification is and how to create a classification key.
- Students create a classification key using objects at home and share the key with a fellow student the next day at school.

Additional Resources

Books

Linking Science and Literacy in the K-8 Classroom, NSTA

Web sites

http://www.sciencenetlinks.com/lessons_printable.cfm?DocID=87

Lessons on classification and a great online classifying activity (Touch of Class E-Sheet)

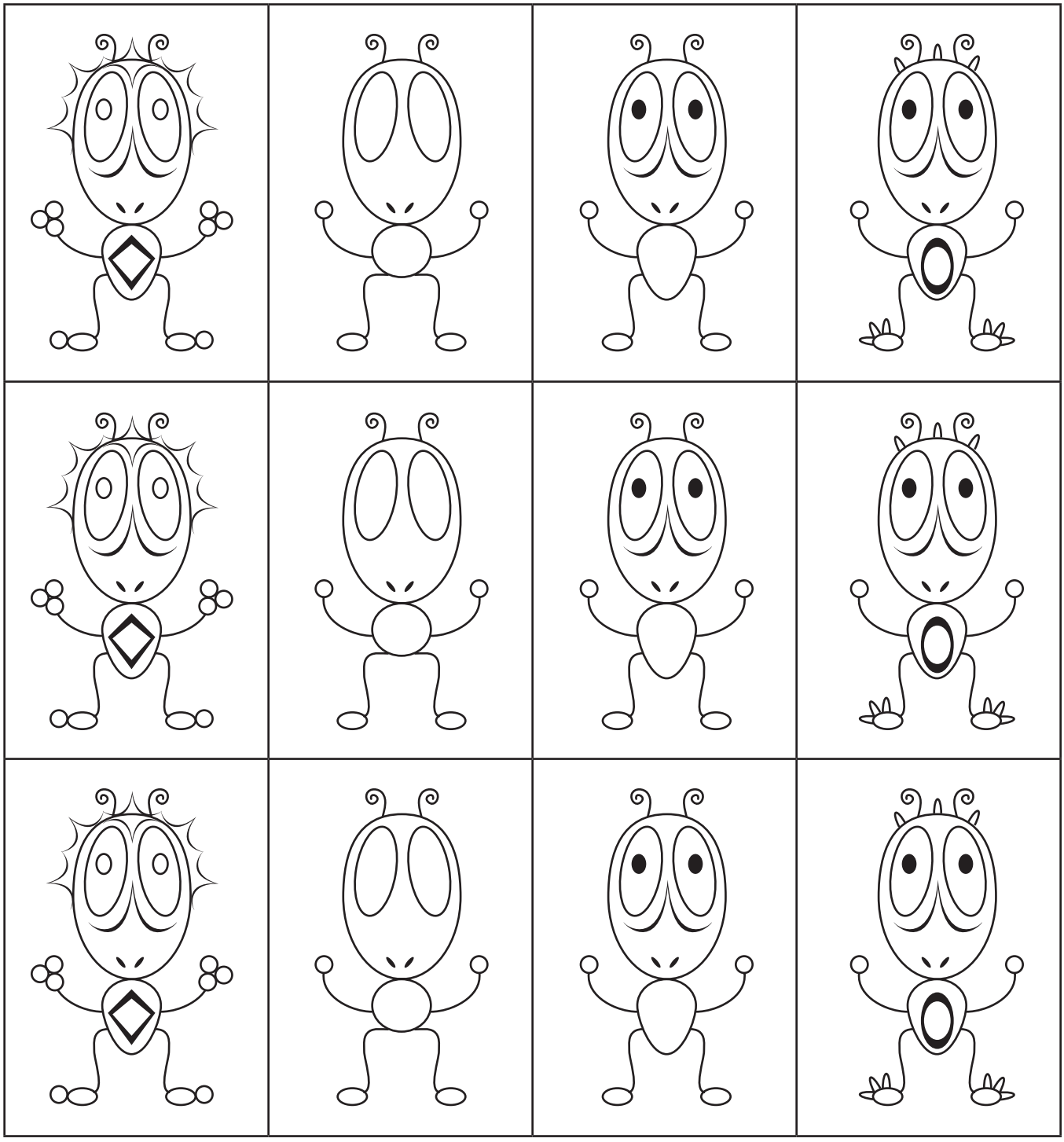
http://www.microbeworld.org/resources/experiment/experiment_creepy_critters.aspx

Fun classifying alien activity

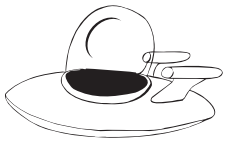
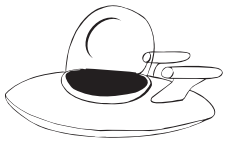
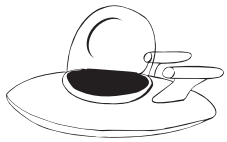
http://www.sciencelinks.com

National Science Teachers Association, www.nsta.org

Alien Cards



Alien Organizer

Ship #1 	Ship #2 	Ship #3 

Rubric for Classification Key

	1	2	3	4
Format	The key has no format. Characteristics are unclear and reader has no idea how to follow the key.	The key has some format and the reader can read and follow parts of it. The characteristics are unclear.	The key is mostly formatted correctly. The characteristics are clear and the reader can mostly follow the key.	The key follows the correct format, with each characteristic clearly labeled. Directions tell reader exactly where to go.
Use	The key was difficult to use and confusing.	Parts of the key were confusing and difficult.	Most of the key was easy to use, but some parts were still confusing to use.	The key is easy to use and very self-explanatory.
Neatness	The information is disorganized and messy. Conventions are missing.	Parts of the information are disorganized without any conventions. Parts are neat.	Most of the information is neat with mostly correct conventions.	All information is neat and conventions are correct.

Name _____ Date _____

Home Classification

1.	Find at least 10 different objects that you can group. Write those items here.
2.	Now group those items. Then draw the groups and give them a title.
3.	Include a written description of the characteristics of each group.

Why Do You Classify This?

Standard V:

Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 3:

Use a simple scheme to classify Utah plants and animals.

Intended Learning Outcomes:

1. Use science process and thinking skills
3. Understand science concepts and principles

Content Connections:

Science V-3; Classifying animals

Science Standard V

Objective 3

Connections

Background Information

Classification is a way to organize information in a hierarchal order. It helps students to see that animals and plants have similarities and differences, for example a bear is an animal and a mammal, but a frog is an animal and a amphibian. Students need to see that animals can be grouped by characteristics that are seen and are not seen; e.g. cold-blooded can't really be seen, but fur can be.

This lesson is to be used after the students have been exposed to many classifying activities. They should be familiar with grouping and simple classification keys.

Research Basis

Wolfe, P. (2001). Brain matters: translating research into classroom practice. A*ssociation for Supervision and Curriculum Development*, Alexandria, VA.

The brain processes abstract information best after experiencing real things first and then symbolic representations. To analyze and compare information, the brain needs to be able to base it on an experience. When learning science, students need to be presented with real-life experiences and meaningful context that build a base for the abstract written problems we usually pose on tests.

Invitation to Learn

Have students rip and fold a piece of paper in their journal to create a flip chart. Ask students to think of an animal they know well, one that they can picture in their mind and describe. Explain that students are going to create a character sketch of the animal. They will describe what the animal looks like, acts like, and places

Materials

- ❏ *Animals Cards*
- ❏ Animal pictures
- ❏ *What Can You Do With a Tail Like This?*
- ❏ Student journals

where it would live. This sketch should give information about the animal without ever saying the name of the animal. Give students time to complete their animal sketch. Encourage them to include LOTS of detail and write in complete sentences. After completing the animal sketch, have students write the name of the animal on the inside of the flip chart. If they finish early they can draw a picture as well. *If you want to carry this into more writing practice students can revise and edit as partners and then present to a group.*

When all students are done, have them share their animal sketches. Students stand up and walk around until the teacher says stop. They turn to the person closest to them and take turns reading their sketch and having the other student guessing the animal.

Instructional Procedures

1. Show the students the book *What Do You Do With A Tail Like This?* Explain that this book talks about similarities in animals like tails, eyes, hands, etc (show pictures/example from the book). Then it talks about how these parts can be different and how they are used.
2. Explain that before you read the story you want to see how much the students know about animals. Pass out the Animal Cards. Assign partners or 3 students to work together. Give the students a few minutes to walk around looking for their matching cards. When they are done talk about what matches they found. Post the matches on a poster for reference.
3. Read the book to the students. Stop and observe matches when they apply to the story. Have students correct themselves when necessary.
4. Explain to students that scientists look at what is similar and different in animals to classify, just like with the grouping activities done before. Explain that today students will get to group pictures of animals into similar groups and defend their reasons. The process should mirror how they have been classifying objects previously.
5. Pass out animal picture cards. Pictures can be grouped in various ways depending on how much your students have already learned about animals. If they know what the differences between reptiles and mammals are, you can have some of both in a group. But a little more challenging is to have a group of spiders, birds, etc. That way, students can focus on characteristics that make the animal unique from other

animals similar to it. Students work in groups to classify them. Encourage students to look at all characteristics.

6. When the students have created groups, help them to make a classification key to show the animals.
7. Assess students as you move through the groups. If students need more practice have them switch cards and repeat the activity with different animals.

Assessment Suggestions

- The *Animal Cards* provide a pre-assessment of students' knowledge of animals and their adaptations.
- Give students a classification key and an animal/plant to identify.
- Students explain how to use a classification key and why they are important.

Curriculum Extensions/Adaptations/ Integration

- Have students gather and group leaves. Include leaves that are native to Utah.
- If your students need more hands-on or kinesthetic activity, have them group stuffed animals instead of pictures.
- Use the internet to have students research about animals. They can write a report or give an oral presentation.
- Use the jigsaw activity to learn about animals. Have groups of students learn about an animal (or group) through the internet, books, etc. Then regroup students so that each animal is represented in the group. Have them give an oral presentation.
- Focus classifying animals or plants from specific habitats. Students group the animals from wetlands, deserts, and forests. Then discuss differences in the adaptations that the animals have to survive.
- Students can write as if they are the animal and explain what life is like.
- Students can create a daily diary as if they were an animal living in the forest, wetland, or desert. (Use *Diary of a Worm* to encourage ideas.)

Family Connections

- Teach a family member how to use a classification key.
- Use a simple plant classification key to identify trees around their homes.
- Give students a classification key and animal pictures; they must identify the animals.

Additional Resources

Books

What Do You Do With a Tail Like This?, by Steve Jenkins and Robin Page; ISBN-10: 0-618-25628-8

Web sites

www.thefuturechannel.com

Great information and videos about animals and scientists. It covers many science topics.

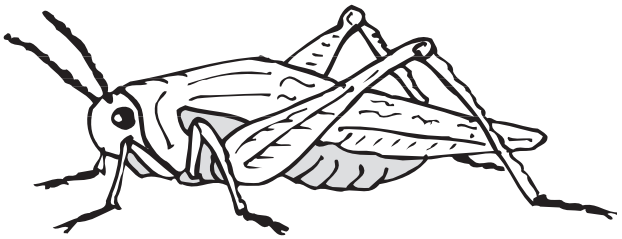
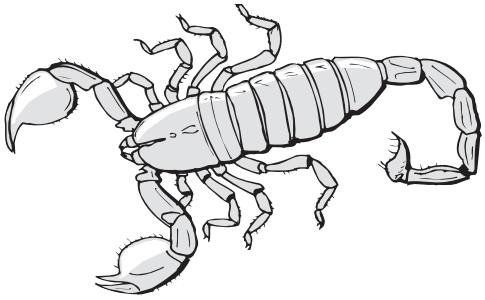
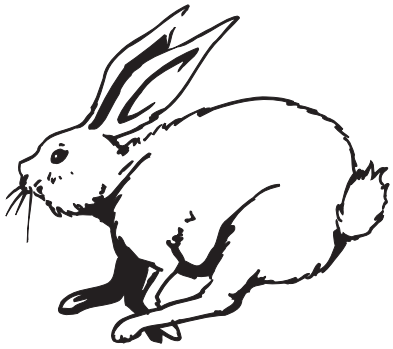
www.wildlife.utah.gov/projectwild/

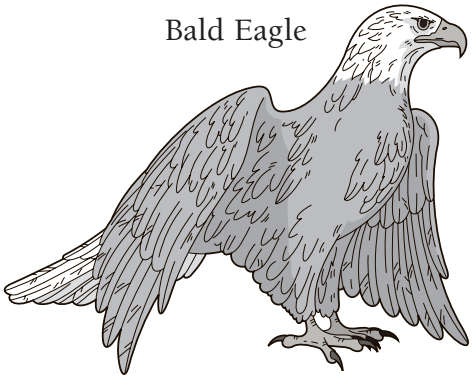
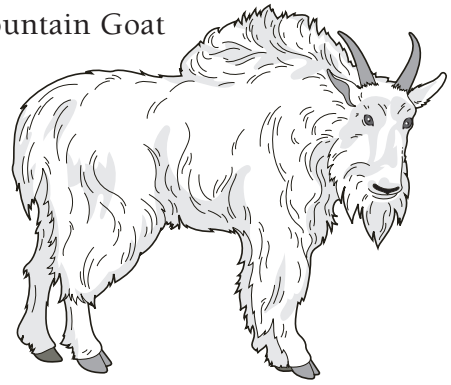
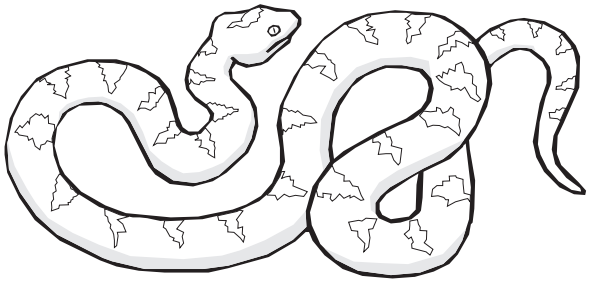
Information about Utah wildlife, includes activities and resources.

Organizations

Project Wild, Diana Vos 801-538-4719, DianaVos@utah.gov

Animal Cards

Cricket 	An insect that chirps by rubbing its wings together. It jumps and has 6 legs. It has a hard body; an exoskeleton.
Skunk 	This mammal sprays its attacker with a stinky, eye stinging liquid. Its fur is black with a white stripe. It is an omnivore.
Scorpion 	This insect eats spiders and small mammals by poisoning its prey with a stinger on the end of its tail. Its exoskeleton is red and it lives in the deserts of Utah.
Jackrabbit 	This mammal lives in the deserts of Utah. It has very tall ears and a small bushy tail. It eats grass and shrubs.

Bald Eagle 	This bird has a white head and sharp claws. It dives from the sky to attack its prey, such as rabbits, small birds, or fish.
Mountain Goat 	This mammal has short horns and fluffy fur. It lives in the mountains and its hooves help it to climb steep, rocky slopes.
Snake 	This reptile has no legs and slithers on the ground. Some can unhinge their mouth to swallow their prey whole.

Appendix

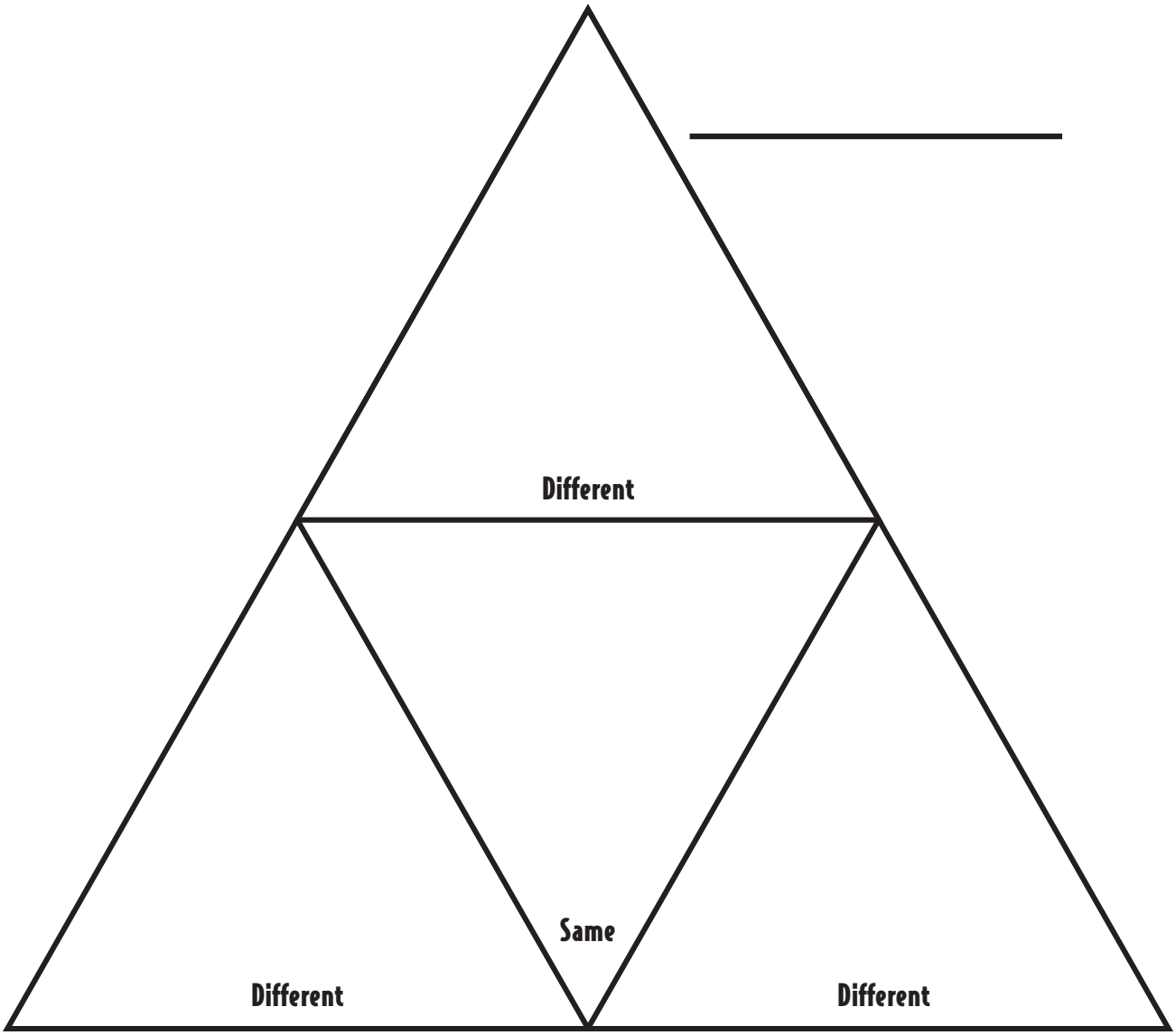
Name _____ Date _____

Compare and Contrast

How Are They Different?

How Are They Different?	How Are They Different?	How Are They Different?

Triangle Compare and Contrast



Name _____ Date _____

Rectangle Compare and Contrast

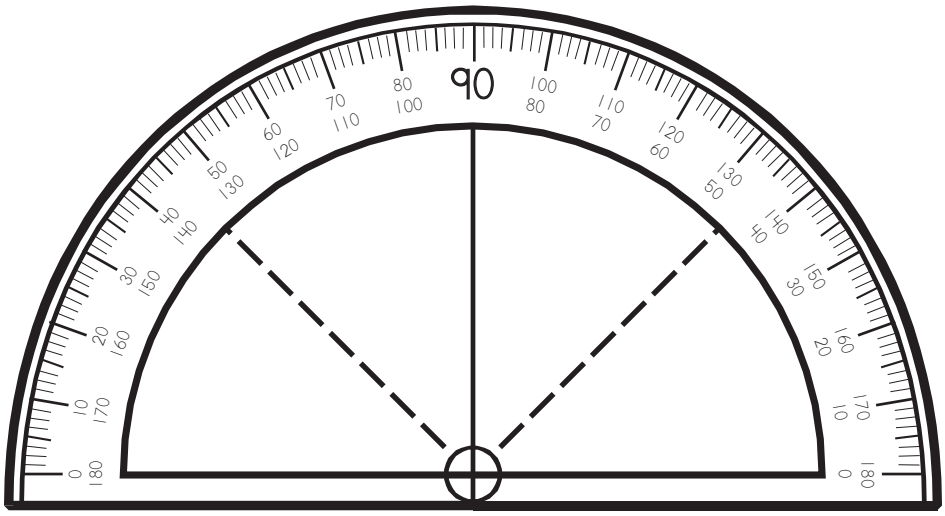
_____ _____

Different	Same	Different

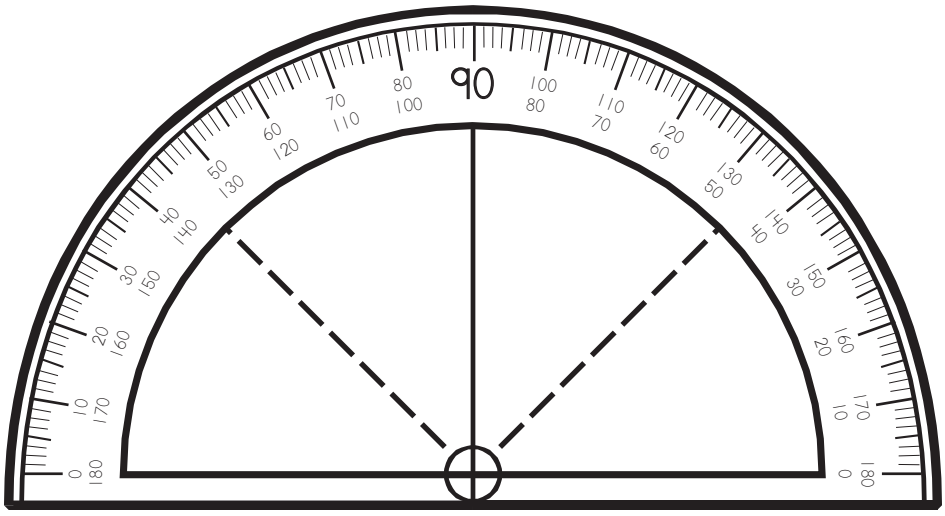
Mystery Word

R	C	R	A	P	T
R	O	T	O		

Label a Protractor



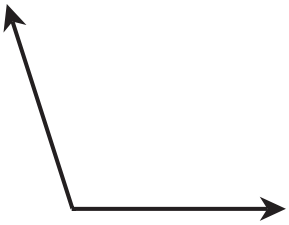
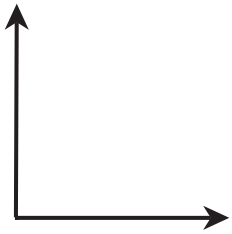
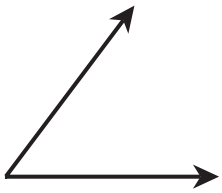
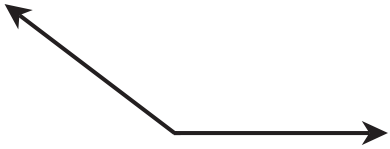
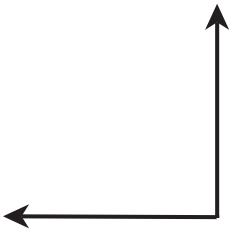
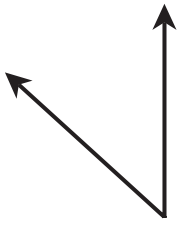
Making My Protractor



Name _____ Date _____

What's My Angle?

Identify the angle. Use a protractor to measure the angle and record.

1.  Angle _____ Degrees _____	2.  Angle _____ Degrees _____
3.  Angle _____ Degrees _____	4.  Angle _____ Degrees _____
5.  Angle _____ Degrees _____	6.  Angle _____ Degrees _____
7.  Angle _____ Degrees _____	8.  Angle _____ Degrees _____

Photomat

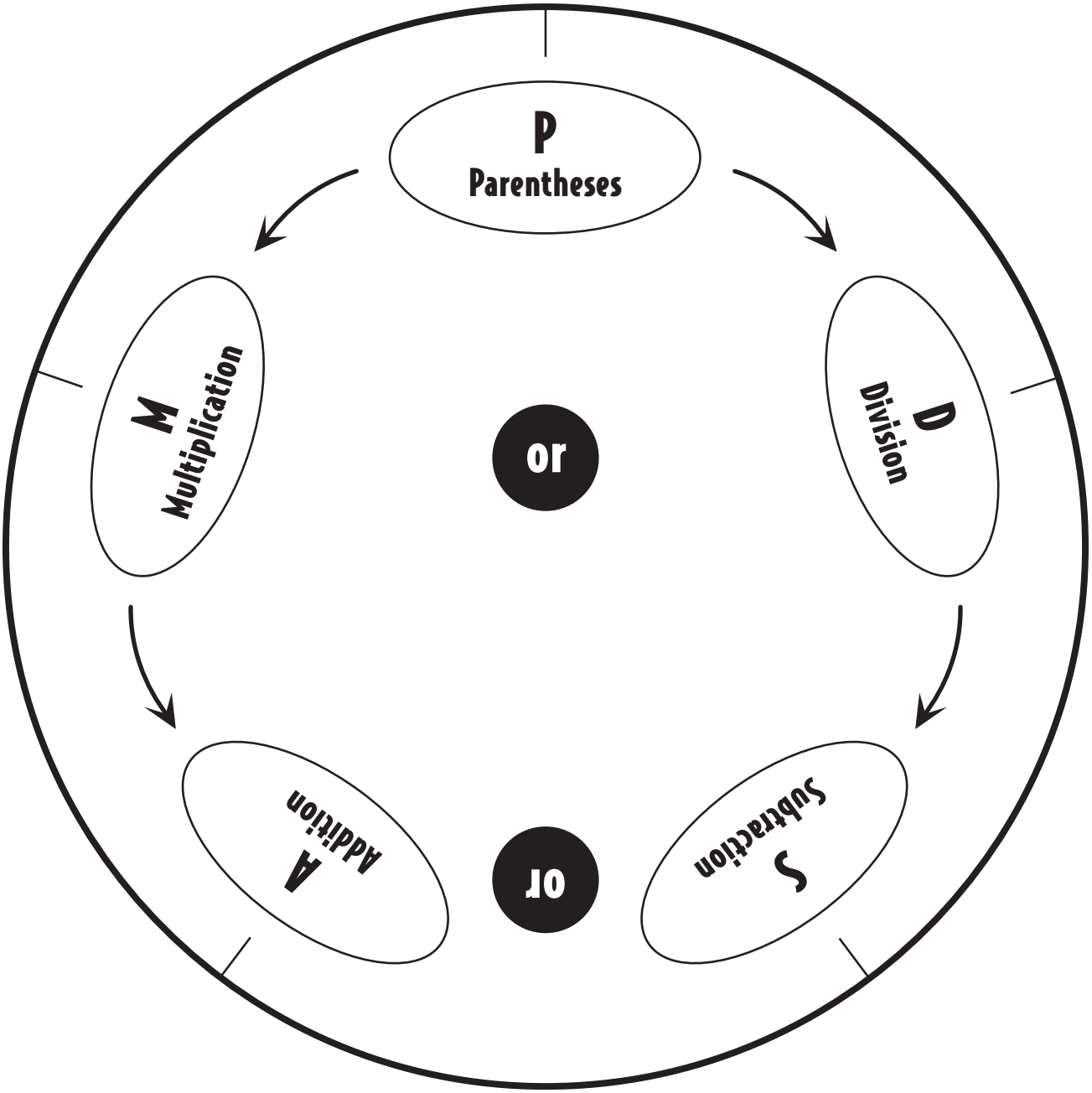
Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____
Place Rock Here	Place Rock Here
Name _____ Date _____ Mass _____ Length _____ Width _____	Name _____ Date _____ Mass _____ Length _____ Width _____

Name _____ Date _____

Take a Tumble Journal Rubric

	4	3	2	1
Measurements	Includes mass, width, length, and volume measurements.	Is missing one measurement.	Is missing two measurements	Is missing more than two measurements.
Visual Description	Includes specific visual characteristics of shape, color, and identifying marks. Uses complete sentences.	Includes specific visual characteristics of two of the three categories. Most sentences are complete.	Includes general visual characteristics of two or more categories. Some sentences are complete.	Includes visual description of one characteristic. Most sentences are fragments.
Predictions/ Observations	Includes a specific prediction of how the rock will change, and a specific observation of the actual changes.	One prediction/ observation is specific. The other is general.	Both the prediction of change and the observation of change is general.	Includes either a prediction or an observation of change but not both.

Order of Operations Compass



Alien Organizer

Ship #1	Ship #2	Ship #3