

Measurement Progressions K-5

Primary measurement concepts can be classified into three main understandings: measurable attributes, time, and area/volume foundations. Though area and volume are measurable attributes, they constitute a more complex understanding building upon the foundations of linear length, liquid volume, and mass. The measure of angles is also included in measurable attributes.

	Measurable Attributes	Time and Money	Area & Volume Foundations
K	<ul style="list-style-type: none"> ● Identify that an object has different attributes that can be measured: e.g. length, height, and weight ● Compare two objects with a measurable attribute in common using vocabulary such as <i>taller, longer, shorter, heavier, lighter, etc.</i> <ul style="list-style-type: none"> ○ When comparing length, students understand that endpoints must be aligned ○ Experiences that help to discover that length is maintained (conservation of length), regardless of items position i.e. <i>a string stretched out in a line is the same length as when it is curved</i> ● Understand that length is defined by the number of equal units, laid end to end, covering the distance from one end point to another <ul style="list-style-type: none"> ○ Units should be laid from end point to end point with no gaps or overlaps ○ Length measure is described with a number and a (nonstandard) unit 	<p>No formal time Math Standards, Social Studies standard involving time: Explain that calendars represent days of the week and months of the year</p> <p>No formal money Math Standards, Social Studies standard involving money: Recognize that U.S. currency comes in different forms</p>	<ul style="list-style-type: none"> ● Informally notice and compare areas, e.g. laying two pieces of paper on top of each other to compare two drawings ● Informally notice and compare volume of two objects by pouring sand/water between two objects to see which holds the most
1	<ul style="list-style-type: none"> ● Estimate the length or height of an object before measuring ● Compare and order three objects by length directly ● Compare two lengths indirectly by using a third object (Transitive Property) ● Recognize a ruler is a tool to measure length. Use a ruler to measure length to the nearest inch. <ul style="list-style-type: none"> ○ Recognize a ruler is a model of multiple equal length units placed end to end without gaps or overlaps ○ Recognize the numbers on the ruler count the end of each length unit ○ Understand the importance of the zero point and end point ○ Understand the length of the object is the distance between two measured lengths on the ruler, regardless of the starting point 	<ul style="list-style-type: none"> ● Read and write time to the hour and half hour ● Identify why telling time is important, e.g. getting to school on time, when to eat lunch, etc. ● Demonstrate using an analog and digital clock when an activity takes place ● Understand that sixty minutes equals one hour ● Use both analog and digital clocks throughout the day to tell and write time <ul style="list-style-type: none"> ○ Know the difference between the big and little hands on a clock ● Identify the values of pennies, nickels, dimes, and quarters ● Combine values of coins, pennies and/or dimes (foundation with ones and tens) 	<ul style="list-style-type: none"> ● Informally learn Area & Volume understanding by composing and decomposing both 2D and 3D shapes (see Geometry progressions) ● Informally (through Science or free exploration) compare the volume of different containers, either by filling with water or using a third container. ● Informally begin packing cubes into containers

	<ul style="list-style-type: none"> • When comparing two objects' lengths, the units used to measure should be the same 	<ul style="list-style-type: none"> • Know how many of each coin is equal to a dollar 	
2	<ul style="list-style-type: none"> • Estimate and then measure lengths of objects to nearest inch, foot, centimeter, or meter • Select and use appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes • Understand basic concepts of a ruler and measuring length <ul style="list-style-type: none"> ○ Units must be of equal size and laid end to end with no gaps or overlaps ○ The numerals on a ruler signify the amount of space that has been covered ○ Correct alignment of the zero-point, the 0 may not be at the beginning of the ruler • Describe how measurements relate to the size of the unit chosen: <ul style="list-style-type: none"> ○ Measure objects twice, using different sized units ○ Compare the number of units needed ○ Recognize that smaller units will require more to cover the length, and vice versa ○ Understand that larger units such as yards can be subdivided into equivalent smaller units • Measure to compare two objects, determine the difference in length in terms of a standard unit • Solve addition and subtraction within 100 word problems in the context of measurement lengths <ul style="list-style-type: none"> ○ Use concrete models and/or pictures to make sense of problems and solve ○ Write an equation using a symbol for the unknown in the problem ○ Explain verbally how the problem was solved ○ Problems should involve the same unit • Represent addition and subtraction by creating number lines on paper/whiteboards. <ul style="list-style-type: none"> ○ Mark and label the number line with equal spaces ○ Use as a model to solve addition or subtraction problem 	<ul style="list-style-type: none"> • Know there are 24 hours in a day with two 12 hour cycles called a.m. and p.m. • Use descriptive terms such as <i>half-past</i>, <i>five after</i>, etc. • Read and write the time correctly to the nearest five minutes <ul style="list-style-type: none"> ○ Use the colon in notation, 1:05 p.m. • Apply skip counting by fives to the five minute intervals on a clock • Solve one and two-step word problems with dollar and coin values <ul style="list-style-type: none"> ○ Addition, subtraction, and/or equal groups situations • Recognize coins and bills and their values <ul style="list-style-type: none"> ○ Bills include: singles, fives, tens, twenties, and hundreds ○ Coins include: pennies, nickels, dimes, and quarters • Use the symbols notations of \$ and ¢ • Compute the value of any combination of coins within a dollar • Compute the combination of any combination of dollars • Relate the value of coins to other coins and one dollar e.g. five nickels are in one quarter, but there are twenty nickels in one dollar 	<ul style="list-style-type: none"> • Students begin to see a rectangular region as decomposable into equal groups of rows and columns (see Geometry Progression)

3	<ul style="list-style-type: none"> • Estimate and measure liquid volumes and masses of objects <ul style="list-style-type: none"> ○ Units used include grams, kilograms, and liters ○ Understand the concept of mass in comparison to weight ○ Understand that when liquid/air takes up space it is measured by volume • Add, subtract, multiply, and divide to solve one-step word problems involving masses or volumes <ul style="list-style-type: none"> ○ Measurements should be given in same units • Measure objects' lengths to the nearest whole, half, and quarter inch <ul style="list-style-type: none"> ○ Using a ruler with only wholes, halves and quarters marked ○ May see in the context of a word problem ○ Students will record data in a line plot (see Data Progressions) • Measure to find the perimeter of real world objects • Measure to find the perimeter of shapes (polygons) created on a geoboard and/or grid paper • Explain how to use a perimeter to find the length of an unknown side • Students will work with rectangles with the same perimeter and different areas, and with rectangles with the same areas, but different perimeters 	<ul style="list-style-type: none"> • Tell and record time to the nearest minute using a clock (analog and digital) • Solve problems involving elapsed time, addition and subtraction of time intervals in minutes <ul style="list-style-type: none"> ○ Elapsed time includes knowing the starting or ending time of an event, or how much time is needed to get something done or go somewhere ○ Use of a predetermined number line and "jumps" can be used as a model to represent elapsed time problems 	<ul style="list-style-type: none"> • Understand that area is the amount of two-dimensional space in a bounded region, or the amount of space that can be covered • Area is most often measured by covering with square units <ul style="list-style-type: none"> ○ Square units should have no gaps or overlaps ○ Square units must be the same size • Work with areas of rectangles and rectilinear figures • Measure areas by counting unit squares • Connect the area of a rectangle to the area model used to represent multiplication (arrays) • Connect the area model to the use of the formula for area of a rectangle (length by width not exceeding 10 x 10) <ul style="list-style-type: none"> ○ Understand and explain why multiplying the whole number side lengths of a rectangle yields the same measurement of area • Decompose both rectangular and rectilinear figures, then add the areas of the decomposed figures to find the total area • Apply the concept of area, including rectilinear figures, to solve real world/word problems
4	<ul style="list-style-type: none"> • Recognize the relative sizes of measurement units <ul style="list-style-type: none"> ○ Benchmark measurements of a unit ○ Measurement equivalents (conversions of units and subunits) ○ Conversion within a single system ○ Express measurements from a larger unit in terms of a smaller unit ○ Units include: kilometer, meter, centimeter, millimeter, liter, milliliter, kilogram, gram, milligram, mile, yard, foot, inch, gallon, quart, pint, cup, ton, pound, ounce, hour, minute and second • Solve measurement word problems including distances, liquid volumes, masses of objects etc. <ul style="list-style-type: none"> ○ Word problems include the use of the four operations 	<ul style="list-style-type: none"> • Solve measurement word problems involving time and money <ul style="list-style-type: none"> ○ Word problems include the use of the four operations ○ May include conversion from larger units to smaller units ○ Calculations may include simple fractions or decimals 	<ul style="list-style-type: none"> • Apply the area and perimeter formulas with both real-world and mathematical problems <ul style="list-style-type: none"> ○ Find a missing width or length of a rectangular room given the area by applying the area formula as an equation with an unknown factor ○ Work with addition and subtraction of whole numbers through 1000 ○ Work with addition and subtraction of fractions with the same denominator ○ Work with multiplication and division of 2-digit by 1-digit or a multiple of 10 by 1-digit, quotients may only be whole numbers

	<ul style="list-style-type: none"> ○ May include conversion from larger units to smaller units ○ Calculations may include simple fractions or decimals ● A table or two-column chart can be used to record conversion measurements ● Understand an angle is formed where two rays or line segments meet at a shared endpoint ● Demonstrate and classify right, acute, obtuse, and straight angles <ul style="list-style-type: none"> ○ At first, this is done without specific measurements of degrees, simply by using the right angle as a benchmark ○ After understanding the measurement of angles with degrees, this can again be revisited with using a 90 degree angle for a benchmark ● Understand an angle as a turn through a circle <ul style="list-style-type: none"> ○ Recognize a circle contains 360 degrees of angles ○ Recognize that an angle that turns through $\frac{1}{360}$ of a circle is called a one degree angle ○ Recognize an angle that turns through n one-degree angles has a measure of n degrees ● Use a protractor (half circle and full circle) to measure and construct angles <ul style="list-style-type: none"> ○ Students may identify angles through 360 degrees ○ Students may construct angles through 180 degrees ● Recognize angles as additive, larger angles can be decomposed into smaller angles of the same sum (within 0-360 degrees) ● Solve addition and subtraction problems to find unknown angles on a diagram (within 0-360 degrees) ● Identify angles in geometric shapes (see Geometry Progressions) 		<ul style="list-style-type: none"> ○ Work with multiplication of fractions by a whole number
5	<ul style="list-style-type: none"> ● Convert different sized measurement units within the same system <ul style="list-style-type: none"> ○ Measurements may include whole number, decimal, and fractional values 		<ul style="list-style-type: none"> ● Recognize volume as an attribute of 3D space ● Understand that volume can be measured by finding the total number of same sized units of

	<ul style="list-style-type: none"> ○ Solve word problems involving conversions of metric and customary units (within the same system) ● Measure objects to $\frac{1}{8}$ of a unit, including length, mass and liquid volume for use in creating Line Plots (see Data Progressions) 		<p>volume required to fill the space without gaps or overlaps (by counting unit cubes or using cubic units)</p> <ul style="list-style-type: none"> ● Find the volume of right rectangular prisms with whole number side lengths by progressing through strategies in the following order: <ul style="list-style-type: none"> ○ Counting the number of cubes needed to (be packed) fill the space (may be labeled with cubic units or exponential units, e.g. cm^3) ○ Packing the bottom layer with cubes, and then using the height to determine the total number of layers needed ○ Use cubes to determine the side lengths (width, length, and height) and connect to using the formulas ○ Use the given side lengths and connect to using the formulas ● Apply the formulas $V = l \times w \times h$ or $V = B \times h$ ● Recognize volume as additive and find volumes of solid figures composed of two non-overlapping prisms
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