**Grade Level/Course:** Grades 3-5

**Lesson/Unit Plan Name:** Do I Really Have to Teach Measurement?

**Rationale/Lesson Abstract:** With measurement being a large component in Common Core, this lesson provides strategies to introduce and convert within the Customary Standard and Metric Systems.

**Timeframe:** Recommend spending a day on each system of units. It will depend on each grade-level and how many units of measurement are being taught.

**Common Core Standard(s):**

3.MD.2: Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

4.MD.1: Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*

4.MD.2: Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

5.MD.1: Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

**Instructional Resources/Materials:**
-Copies of Unit of Measurement Charts
-Items to represent relative size of different units: measuring tape, rulers, maps, beaker, dropper, pitcher, gallon jug, scale, soda bottle, etc.

**Activity/Lesson:**

Introduction
Learning the relative size for each unit of measurement is like teaching a kindergartener recognizing numbers. They need to memorize what the number six looks like and it comes before seven and after five. But when we have kindergarteners build or draw a visual representation of the quantity of five, six, and seven next to each other, kindergarteners begin to recognize the number six to its quantity and the value compared to other numbers. We will use the same approach to introduce each unit of measurement.

Build Background
Use a measuring tape or ruler to draw a line that is one inch long and a line that is one foot long on the board. Ask students why our height is measured in feet and not in inches. Have students share their reasoning with their partner and with the class. Discuss with students that measuring our height in feet is a more efficient way to measure our height than in inches, because foot is a larger unit than inch. Ask students for some examples of items that will be more efficient to measure with inches (i.e. length of an arm, waist, width of desk, etc.).

Activity: Unit of Measurement Hunt
The following charts provide the relative size of each unit of measurement. Have samples of each measurement ready to give students visual representation of the measurement. For example, when introducing Customary Length, have items that measure an inch, a foot, a yard ready to display. You may want to show distance of one location to another on a map to represent a mile. Once students understand the relative size of each measurement, introduce the Unit of Measurement Hunt to students. Students are to find as many examples that use the specific unit of measurement and create a log. Allow students to continue the activity outside of school so they can explore measurement of items they use in their everyday life. Encourage students to work on the hunt with their families. You may have to provide some extra examples when students get to the Metric System since many of our everyday items are in the US Customary System.

# Conversion Chart

| Customary Length | |
|---|---|
| 12 in | 1 ft |
| 3 ft | 1 yd |
| 1760 yd | 1 mi |

| Customary Weight | |
|---|---|
| 16 oz | 1 lb |
| 2000 lb | 1 ton |

| Customary Capacity | |
|---|---|
| 8 fl oz | 1 c |
| 2 c | 1 pt |
| 2 pt | 1 qt |
| 4 qt | 1 gal |

| Metric Length | |
|---|---|
| 10 mm | 1 cm |
| 100 cm | 1 m |
| 1000 m | 1 km |

| Metric Mass | |
|---|---|
| 1000 mg | 1 g |
| 1000 g | 1 kg |

| Metric Capacity | |
|---|---|
| 1000 mL | 1 L |

# Customary Length

**shorter** **longer**

| **inch** | **foot** | **yard** | **mile** |
|---|---|---|---|
| **in** | **ft** | **yd** | **mi** |
| olive | foot-long sandwich | baseball bat | 4 laps around the track |

# Customary Weight


**lighter** **heavier**

| ounce | pound | ton |
|---|---|---|
| **oz** | **lb** | **T** |
| screw | bag of flour | truck |

# Customary Capacity


**fluid ounce**
**fl oz**

bottle of nail polish

**cup**
**c**

glass of orange juice

**pint**
**pt**

small carton of ice-cream

**quart**
**qt**

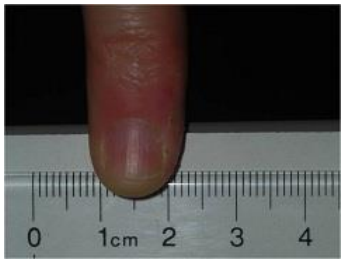
large juice bottle

**gallon**
**gal**

jug of milk

# Metric Length

shorter




longer

**millimeter**
**mm**

thickness of a dime

**centimeter**
**cm**

width of your pinky finger

**meter**
**m**

height of a guitar

**kilometer**
**km**

3 laps around the track

# Metric Mass


**smaller** **larger**

| **milligram** | **gram** | **kilogram** |
|---|---|---|
| **mg** | **g** | **kg** |
| a leaf | a thumbtack | a genuine gold coin |

# Metric Capacity


**smaller** **larger**

**milliliter**
**mL**

a dropper

**liter**
**L**

a large soda bottle

**Converting Unit of Measurements:**
Function tables and decomposition can be used to convert any unit of measurement within the same measurement system.

**Example #1**
**How many inches are in 4 feet?**
First, we need to know how many inches are in one foot.
1 foot = 12 inches
**Line Model**
Now we can start building our line model with 1 foot on one line and the equivalent 12 inches on the line below it. Since we need to find out how many inches are in 4 feet, we will build our model piece-by-piece until we reach 4 feet.

| Unit of Measurement | | | | |
|---|---|---|---|---|
| feet | 1 *ft* | 1 *ft* | 1 *ft* | 1 *ft* |
| inches | 12 *in* | 12 *in* | 12 *in* | 12 *in* |

Now we can add our feet and inches to find out how many inches are in 4 feet.

$$\begin{aligned} 1\,ft &= 12in \\ 1\,ft &= 12in \\ 1\,ft &= 12in \\ +1\,ft &= +12in \\ \hline 4\,ft &= 48in \end{aligned}$$

Is there a shorter way to show this repeated addition?

$$4 \times 1\,ft = 4\,ft$$
$$4 \times 12in = 48in$$

**Function Table**

| *(x)* **ft** | *(y)* **in** |
|---|---|
| 1 | 12 |
| 2 | 24 |
| 3 | 36 |
| 4 | 48 |
| x(12) | y |

**Rule:** $12x = y$ **or** $x = \frac{y}{12}$

**∴ There are 48 inches in 4 feet**

**Discuss with students which rule is best for finding feet to inches and which is best for inches to feet.*

**Decomposition**

$$unit \bullet \frac{conversion}{equivalent\ unit}$$
$$= 4\,ft \bullet \frac{12in}{1\,ft}$$
$$= \frac{4\,ft}{1} \bullet \frac{12in}{1\,ft}$$
$$= \frac{4 \bullet ft \bullet 12 \bullet in}{ft}$$
$$= 4 \bullet 12 \bullet in$$
$$= 48 \bullet in$$
$$= 48in$$

**This method can be challenging for 5th grade students. Introduce this method based on your students' abilities.*

**You Try**

**How many feet are in 84 inches? Solve using two different methods.**

**Example #2**
**How many meters are in 600 centimeters?**
100cm=1m

**Line Model**

| Unit of Measurement | | | | | | |
|---|---|---|---|---|---|---|
| meters | 1 *m* | 1 *m* | 1 *m* | 1 *m* | 1 *m* | 1 *m* |
| centimeters | 100 *cm* | 100 *cm* | 100 *cm* | 100 *cm* | 100 *cm* | 100 *cm* |

$$\begin{aligned} 1m &= 100cm \\ 1m &= 100cm \\ 1m &= 100cm \\ 1m &= 100cm \\ 1m &= 100cm \\ \underline{+1m} &= \underline{+100cm} \\ 6m &= 600cm \end{aligned}$$

**Or**

$$6 \times 1m = 6m$$
$$6 \times 100cm = 600cm$$

**Function Table**

| *(x)* **m** | *(y)* **cm** |
|---|---|
| 1 | 100 |
| 2 | 200 |
| 3 | 300 |
| 4 | 400 |
| 5 | 500 |
| 6 | 600 |
| x(100) | y |

**Rule:** $100x = y$ **or** $x = \frac{y}{100}$

**∴ There are 6 meters in 600 centimeters.**

**Decomposition**

$$unit \bullet \frac{conversion}{equivalent\ unit}$$
$$= 600cm \bullet \frac{1m}{100cm}$$
$$= \frac{600cm}{1} \bullet \frac{1m}{100cm}$$
$$= \frac{600 \bullet cm \bullet m}{100 \bullet cm}$$
$$= \frac{6 \bullet \cancel{100} \bullet m}{\cancel{100}}$$
$$= 6 \bullet m$$
$$= 6m$$

**You Try**

**How many centimeters are in 9 meters?**

**Example #3**

**Stacy went to the craft store to buy 2 yards of yarn to knit a scarf. The yarns she wants are measured in inches. How many inches of yarn does Stacy need?**

First convert yards to feet, then convert the feet to inches.

**Line Model**

| Unit of Measurement | | |
|---|---|---|
| yards | 1 *y* | 1 *y* |
| feet | 3 *ft* | 3 *ft* |

$$\begin{array}{r} 1y = \ 3\,ft \\ +1y = +3\,ft \\ \hline 2y = \ 6\,ft \end{array}$$

**Or**

$$2 \times 1y = 2y$$
$$2 \times 3\,ft = 6\,ft$$

We know that 2 yards is equal to 6 feet. Now we will find how many inches are in 6 feet.

| Unit of Measurement | | | | | | |
|---|---|---|---|---|---|---|
| feet | 1 *ft* | 1 *ft* | 1 *ft* | 1 *ft* | 1 *ft* | 1 *ft* |
| inches | 12 *in* | 12 *in* | 12 *in* | 12 *in* | 12 *in* | 12 *in* |

$$\begin{array}{r} 1\,ft = \ 12in \\ 1\,ft = \ 12in \\ 1\,ft = \ 12in \\ 1\,ft = \ 12in \\ 1\,ft = \ 12in \\ +1\,ft = +12in \\ \hline 6\,ft = \ 72in \end{array}$$

**Or**

$$6 \times 1\,ft = \ ft$$
$$6 \times 12in = 72in$$

**2 yards = 6 feet = 72 inches**

**Function Tables**

**Yards to Feet**

| *(x)* **y** | *(y)* **ft** |
|---|---|
| 1 | 3 |
| 2 | 6 |
| *x*(3) | *y* |

**Rule:** $3x = y$ **or** $x = \frac{y}{3}$

**Feet to Inches**

| *(y)* **ft** | *(z)* **in** |
|---|---|
| 1 | 12 |
| 2 | 24 |
| 3 | 36 |
| 4 | 48 |
| 5 | 60 |
| 6 | 72 |
| *y*(12) | *z* |

**Rule:** $12y = z$ **or** $y = \frac{z}{12}$

**Decomposition**

$$know\ unit \bullet \frac{conversion\ y}{equivalent\ unit} \bullet \frac{conversion\ z}{equivalent\ unit}$$

$$= 2yd \bullet \frac{3ft}{1yd} \bullet \frac{12in}{1ft}$$

$$= \frac{2yd}{1} \bullet \frac{3ft}{1yd} \bullet \frac{12in}{1ft}$$

$$= \frac{2 \bullet yd \bullet 3 \bullet ft \bullet 12 \bullet in}{yd \bullet ft}$$

$$= 2 \bullet 3 \bullet 12 \bullet in$$

$$= 6 \bullet 12 \bullet in$$

$$= 72 \bullet in$$

$$= 72in$$

**∴ Stacy will need 72 inches of yarn.**

**You Try**

**Ken is baking a cake for his mom's birthday. The cake recipe he is using requires 48 fluid ounces of milk. How many pints of milk will Ken need to buy from the store?**

**Example #4**

**Tracy and her sisters are selling lemonade. Tracy made 1 liter of lemonade, Stacy made 2.5 liters of lemonade and Macy made 3500 milliliter of lemonade. How many total milliliters of lemonade did the sisters have to sale?**

**Line Model**

Unit of Measurement

| liters | 0.5 *L* | 0.5 *L* | 0.5 *L* | 0.5 *L* | 0.5 *L* |
|---|---|---|---|---|---|
| milliliters | 500 *mL* | 500 *mL* | 500 *mL* | 500 *mL* | 500 *ml* |

**Function Table**

| *(x)* **L** | *(y)* **mL** |
|---|---|
| 0.5 | 500 |
| 1 | 1000 |
| 1.5 | 1500 |
| 2 | 2000 |
| 2.5 | 2500 |

$$\begin{aligned} 0.5L &= 500mL \\ 0.5L &= 500mL \\ 0.5L &= 500mL \\ 0.5L &= 500mL \\ \underline{+0.5L} &= \underline{+500mL} \\ 2.5L &= 2500mL \end{aligned}$$

We know 0.5L+0.5L is equal to 1L, so 1L is equal to 1000mL and 2.5L is equal to 2500mL.

| **Tracy** | **Stacy** | **Macy** |
|---|---|---|
| **1 L** | **2.5 L** | **3500 mL** |
| **1000 mL** | **2500 mL** | **3500 mL** |
| **Total milliliters of lemonade** | | |

$$\begin{aligned} &= 1L + 2.5L + 3500mL \\ &= 1000mL + 2500mL + 3500mL \\ &= 1000mL + 2000mL + 500mL + 3000mL + 500mL \\ &= 6000mL + 1000mL \\ &= 7000mL \end{aligned}$$

**∴ The sisters have a total of 7000 milliliter of lemonade to sale.**

**You Try**

**Jackson, Antonio and Scott are training for a relay team. During practice, Jackson ran 3.5 kilometers, Antonio ran 2075 meters and Scott ran 4.5 kilometers. How many kilometers did they ran all together?**

**Assessment:**

**1. Which of the following unit of measurement is equivalent to 1 gallon?**

| | | |
|---|---|---|
| **A.** 4 cups | Ⓐ Yes | Ⓑ No |
| **B.** 4 quarts | Ⓐ Yes | Ⓑ No |
| **C.** 8 pints | Ⓐ Yes | Ⓑ No |
| **D.** 8 fluid ounces | Ⓐ Yes | Ⓑ No |

**2. How many ounces are in 5 pounds? Solve using two different methods.**

**Assessment: Solution**

**1. Which of the following unit of measurement is equivalent to 1 gallon?**

| | | |
|---|---|---|
| **A.** 4 cups | Ⓐ Yes | ● No |
| **B.** 4 quarts | ● Yes | Ⓑ No |
| **C.** 8 pints | ● Yes | Ⓑ No |
| **D.** 8 fluid ounces | Ⓐ Yes | ● No |

**2. How many ounces are in 5 pounds? Solve using two different methods.**

I know there are 16 ounces to 1 pound.

**Line Model**

| Unit of Measurement | | | | | |
|---|---|---|---|---|---|
| pound | 1 *lb* | 1 *lb* | 1 *lb* | 1 *lb* | 1 *lb* |
| ounces | 16 *oz* | 16 *oz* | 16 *oz* | 16 *oz* | 16 *oz* |

$$\begin{aligned} 1lb &= 16oz \\ 1lb &= 16oz \\ 1lb &= 16oz \\ 1lb &= 16oz \\ \underline{+1lb} &= \underline{+16oz} \\ 5lb &= 80oz \end{aligned}$$

**Or**

$$\begin{aligned} 5\times 1lb &= 5lbs \\ 5\times 16oz &= 80oz \end{aligned}$$

**Function Table**

| *(x)* ***lb*** | *(y)* ***oz*** |
|---|---|
| 1 | 16 |
| 2 | 32 |
| 3 | 48 |
| 4 | 64 |
| 5 | 80 |
| x(16) | y |

**Rule:** $16x = y$ **or** $x = \frac{y}{16}$

**∴ 5 lbs = 80oz**