Measurement

Measurement Systems
Grades 4-5

Rationale

- Choosing accurate units of measurement is key when measuring objects using both the metric and customary systems. Measurement involves multiple skills including, choosing the correct unit of measurement, measuring accurately using measurement tools, and making conversions with the measurements. Mistakes in these areas lead to incorrect solutions in measurement. In this lesson students will discover the importance of all of these factors by being given the opportunity to make decisions when measuring and then discussing their choices with their classmates.

Goal

- To make accurate choices of measurement units, measure items accurately, and make conversions within the metric and customary systems of measurement
- [Grade 5] To use knowledge of the metric and customary systems to solve mulit-step, real world problems involving measurement and measurement conversions

Standard

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

Objectives

- Students will explore units of measurement in both the metric and customary systems.
- Students will measure accurately using measurement tools.
- Students will make accurate measruement conversions within metric and customary measurement systems.
- *Grade 5 Connection:* Students will solve mulit-step real world problems that involve the measurement systems.

Materials

- Measurement tools used to measure length in both metric and customary systems: ruler, yard stick, meter stick, tape measure, etc. (One set of tools per group.)
- Items to be measured accoring to the length of the item: rope, string, etc. (One set of 3 items per group.)
- Pencils/Colored Pencils (blue and red)
- ***Measurement systems chart***
- ***Measurement record sheet***

Procedures:

Duration:

This lesson should take between 45-60 minutes.

Structure:

Part I – Grade 4 Standard Connection:

- The instructor will begin the lesson by holding a discussion about systems of measurement. Using an overhead copy of the ***measurement systems chart*** students will offer various measurement systems used to measure the length, weight, time and capacity. (This is meant to be a brainstorming activity that can by used at the beginning of each lesson for a particular unit of measurement or at the beginning of a unit on measurement.) "If we were going on a measurement hunt today, what tools might you need and how might we use the tools? What objects are measurable and what units do we use to define our measurements?" "For example, I can just say that this book is "5." What's missing?" Students should offer units to measure length, weight, time and capacity in both metric and customary units (see completed measurement systems chart).
- Introduce the measurement activity by showing students the items that will be measured during the small group work period. These items (3 measurable items for length such a piece of rope, stick of gum, string, strips of paper, etc.). The instructor will tell the students that all of the small groups will receive the same items. "All of our small groups will be receiving measurable items and all of the groups must record the length of each of the items to be sure they all measure the same length." "Each group will have the opportunity to choose the measurement tool and unit to measure the length of each item." "When our measurements have been recorded we will share our findings and discuss the units chosen to measure each item and clarification for why the particular units were used."
- Students will be given various measurement tools to measure the length of the items to be measured as well as the ***Measurement Record Sheet*** to record the

length of each item. The instructor will ask students to only record one measurement for each item using either the metric or customary system.

- Students will begin measuring items in small groups and recording accurate measurements of length.
- As student finish the small group measurement work, the instructor will have students share the measured length of each of the given items. This will be an opportunity for the instructor to discuss all possibilities for measuring the items given the various tools and measurement units. For example: "What unit of measurement was used to measure the longest item? Why was this unit chosen? Are there other units of measurement could have been used? What would the measurement look like?" This is also an opportunity to discuss how length is measured given limited resources and conversion. For example, measuring a long item with only access to a ruler. "What would happen if you were only given a ruler to measure the longest item found in the set of objects to be measured today?" "How do we find the length of the items and convert the measurement to a more appropriate unit of measurement?"
- Using the student responses, the instructor can use the ***Measurement Record Sheet*** on the overhead or large chart paper to help students show the conversions between units of measurement. Students will record conversion on their own charts.
- Students will convert all measured items in both metric and customary systems. This work may be done as a large discussion group or in small group. This activity is an opportunity for the instructor to discuss with the students how the conversions are made. "How do we know what the measurement of an item would look line in mm if we measured the item to the nearest cm? How many mm are in one cm?" Students may use their measurement tools in order see that both lengths are equivalent. They can then discuss how they could compute the other measurement without looking t the measuring tools. "We see that we could say this measurement was 30 cm or 300 mm, what is the relationship between those two measurements?"
- *Closing:* With the students make a list of all of the conversions that were discovered during the lesson. If time remains, use their new conversion rules, allow students to challenge each other by suggesting measurements for their classmates to convert.

Part II – Grade 5 Standard Connection

- The instructor will show students how the measurement task they just completed relates to the real world by posing a multi-step real world problem related to measurement of length and conversions within a measurement system. This example may look like the following: "We are having a celebration and have various lengths of crepe paper for the table decorations. Our tables are 2 feet long, but we do not have any pieces of crepe paper that are long enough to string the entire length of the table. We do have pieces in the following lengths: 2 in., 7 in., 8 in., 1 ft., 10 in., 9 in., 4 in., 5 in., 6 in.

Which lengths could we combine to cover a table and how many total tables could be covered?"

- This multi-step real world problem may be solved in a large group or in small group work settings. Discuss the solution and the conversion needed to answer the question accurately.
- *Closing:* The instructor will hold a discussion to review the importance of the work completed in this lesson today and it's relevance to the real world.

Teacher Tips

- To show the difference between metric and customary units of measurement on the ***Measurement Systems Chart***, the instructor may use two different colored pens/pencils to record the unit names. For example the metric units (mm, cm, k) may all be listed on the chart in red and the customary units (in., ft., yd., mi.) may all be listed in blue on the chart.
- Students may also use different colors to record metric and customary units on the ***Measurement Record Sheet*** to show the different measurement systems.
- As students work in small groups to measure the length of the various items, the instructor may wish to assign cooperative group roles for each student in the group. For example students may share the responsibilities for the following roles: measurer, checker, recorder. These roles may be rotated within the group to give all students an opportunity to practice measuring for length.
- If students finish before other groups, have the small groups brainstorm items that might be measured using the various units of measurement listed on the ***Measurement Systems Chart***.
- For practical reasons, the largest units won't be used in this lesson (i.e. mile, kilometer.) Discuss when those might be appropriate and why they aren't appropriate for this lesson. (Although we could covert to fractional parts of those units, would it be necessary or appropriate?)

Extension Activities

- Student will be assigned the task of measuring 10 or more items at home or within the classroom. The student will identify the tool used for measure the length of an item, the unit (metric or customary) used to calculate the length, and then show the conversions within the measurement system.
- Students will use the same 10 items to measure the length of the items using another measurement system than used in the first extension activity.
- Students will create real world problems that require the measurement of length. Write the problems giving detail for the problem and then pose a question related to the measurement of an item(s) and the conversion of the unit of measurement. Challenge classmates with the real world problems by sharing the problems as a large group or in small group settings.
- *Measurement of weight:* This lesson can be extended to explore the units used to measure weight in metric or customary measurement systems (milligram, *gram,, kilogram*, *ounce, pound*, ton. Provide students with items to be

measured and an appropriate measurement tool used to measure weight such as a scale that includes both metric and customary units. Proceed through the lesson steps to promote discussion and practice measuring weight. The ***Measurement Record Sheet*** can be used for this lesson. (The standard includes those measurements listed in italics above.)

- *Measurement of capacity:* This lesson can be extended to explore the units used to measure capacity in metric and customary measurement systems (*milliliter), liter ,* kiloliter, fluid ounce, cup, pint , quart, and gallon. Provide students with the items to be measured and appropriate measurement tools such as containers that measure the above listed units. Proceed through the lesson steps to promote discussion and practice measuring capacity. The ***Measurement Record Sheet*** can be used for this lesson. (The standard includes those measurements listed in italics above.)
- *Measurement of time:* This lesson can be extended to explore the units used to measure time (*seconds, minutes, hour),* and possibly even weeks, and months). For this extension students should be provided with real life situations where time may be chosen as the appropriate unit of measurement to be used and then have students practice using a time measurement tool such as a clock, stop watch, timer, etc. to measure time. An example question to students might be as follows: If we were calculating the amount of work we did at home on schoolwork, what measurement unit might we choose? Discuss the option for measuring time and when time is measured. Proceed through the lesson steps discussing the units used to measure time and challenge students with problems that require the measurement and conversion of time. (The standard includes those measurements listed in italics above.)

Measurement Record Sheet – Length

		Metric Units	
Item Measured	cm	k	km
1			
2			
3			

		Customary Units		
Item Measured	in.	ft.	yd.	mi.
1				
2				
3				

Measurement Record Sheet – Weight

		Customary Units	
Item Measured	oz.	lb.	T.
1			
2			
3			

		Metric Units		
Item Measured	mg	g	kg	MT
1				
2				
3				

Measurement Record Sheet – Capacity

		Customary Units		
Item Measured	fl. oz.	Pt.	qt.	gal.
1				
2				
3				

		Metric Units	
Item Measured	ml	l	kl
1			
2			
3			

Measurement Systems Chart