Measuring Mania

Reporting Category	Measurement
Topic	Making ballpark comparisons between measurements
Primary SOL	6.9 The student will make ballpark comparisons between measurements in the U.S. Customary System of measurement and measurements in the metric system.

Materials

Activity 1: Length

- Chart paper
- Marker
- Tools to measure length, e.g., rulers, yardsticks, centimeter tapes, meter sticks, meter trundle wheel
- Internet access
- Measuring Length graphic organizer (attached)
- Measuring Length: Ballpark Comparisons graphic organizer (attached)

Activity 2: Weight/Mass

- Measuring Weight/Mass: Ounces vs. Grams handout (attached)
- Measuring Weight/Mass: Pounds vs. Kilograms handout (attached)
- Marker
- Balance scale
- Pound, ounce, gram, and kilogram weights
- Three 1-pound boxes of sugar
- Paper clips
- Nickels
- Ballpark Comparisons for Measurement chart (created in Activity 1)

Activity 3: Volume

- Liter bottle
- Quart bottle
- Marker
- Dry rice (or water)
- Funnel
- Shallow tray
- Ballpark Comparisons for Measurement chart (created in Activity 1)

Activity 4: Temperature

- Chart paper
- Marker
- Eight temperature cards (see below)
- Ballpark Comparisons for Measurement chart (created in Activity 1)

Vocabulary

Activity 1: Length

inch, foot, yard, mile, centimeter, meter, kilometer, ruler, yardstick, centimeter tape, meter trundle wheel, length, unit, unit of measurement

Activity 2: Weight/Mass

ounce, pound, gram, kilogram, balance scale, mass, weight

Activity 3: Volume

quart, liter, volume

Activity 4: Temperature

Fahrenheit, Celsius, temperature

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

This lesson is split into four activities. Read through each to determine whether you want to combine activities, and if so, how. Activity 1 should be completed first as it includes a discussion about ballpark measurements, but the remaining activities may be completed in any order.

Activity 1: Length

Prior to the activity, draw on chart paper two charts similar to the following:

U.S. Customary System		
Tool	Unit	Real-Life Use

Metric System		
Tool	Unit	Real-Life Use

1. Distribute copies of the Measuring Length graphic organizer. Put students into groups of four, and give each group a set of tools for measuring length. Remind students that there are two different systems of measurement, the U.S. Customary system and the metric system. Briefly review why there are two different measurement systems and where each system is used.
2. Have students sort the tools according to the measurement system to which they belong. Then, ask students to list on their graphic organizers each tool, its unit of measurement, and a real-life situation in which the tool would be the appropriate one to use. Give the following example: Metric system – Tool: meter stick; Unit: meter; Real-Life Use: measure height of a tall bookcase. Have students fill in the information about the meter stick on their organizers. Then, allow groups 5-10 minutes to complete their organizers for the remaining tools.
3. Discuss students' responses listed on their organizers. Make sure students understand the term *unit* and that each tool has a unit of measurement assigned to it. Also, make sure students understand that different units and tools are used at different times, depending on the attributes of the object being measured.
4. Tell students that you can measure the same object in either system of measurement and that it is important to know how the two systems compare to each other. To understand

how they compare, we can make ballpark comparisons. Make sure students understand that a ***ballpark comparison*** **is a reasonable estimate of a unit of measure in relation to another unit of measure.**

5. Ask students to look at the tools in both groups and pair the tools whose units are of similar length. For example, a meter stick pairs with a yardstick because a meter and a yard are units of similar length.
6. Have students work in pairs to find objects around the room that are the length of each unit of measure. They will be measuring the same object in U.S. Customary units and in metric units to discover the ballpark comparison. For example, students will find and measure an object that is about one inch long. They will measure the same object in centimeters. Students will be comparing inch/centimeter, foot/centimeter, meter/yard, and mile/kilometer, using the computer to find distances in miles and kilometers to various locations in the area. Have students record their measurements in the Measuring Length: Ballpark Comparisons graphic organizer.
7. After students have had time to measure objects and make comparisons, pull the class together to discuss the results. Record the class data on the board, and determine the ballpark comparison for inch/centimeter, foot/centimeter, meter/yard, and mile/kilometer. On chart paper, create a chart titled "Ballpark Comparisons for Measurement," and list the following comparisons:
   - 1 inch is about 2.5 centimeters (or about the diameter of a quarter).
   - 1 foot is about 30 centimeters. (Point out that there is no metric unit of measurement similar to 1 foot.)
   - 1 meter is a little longer than a yard (or about 40 inches).
   - 1 mile is slightly farther than 1.5 kilometers (or 1 kilometer is slightly farther than 0.5 mile).

   You will be adding to this Ballpark Comparisons for Measurement chart in each activity of this lesson.

Activity 2: Weight/Mass

1. Write the words *weight* and *mass* on the board, and take time to discuss the difference between the two terms, how each is used, and how each is determined.
2. Distribute copies of the Measuring Weight/Mass: Ounces vs. Grams and Measuring Weight/Mass: Pounds vs. Kilograms handouts.
3. Set up two stations for students to explore U.S. Customary units and metric units of weight and mass. (You might have more than one station for each system of measurement.) At the ounces-grams station, place some *labeled* ounce and gram weights, along with some paper clips and nickels. Have students visit this station to complete the Measuring Weight & Mass: Ounces vs. Grams handout. Here, students should first compare an ounce to a gram without using a balance. Observe how students make this comparison: some may use their hands as a balance scale. When using the actual balance scale, they should discover the following:
   - 1 ounce is about 28 grams.
   - 1 gram is about the weight of 1 paper clip (or 5 grams is about the mass of 1 nickel).

4. At the pounds-kilograms station, place some *labeled* pound and kilogram weights, along with some everyday objects that weigh a pound or a kilogram, e.g., a 1-pound box of sugar, two 1-pound boxes of sugar taped together and labeled "kilogram." Have students visit this station to complete the Measuring Weight & Mass: Pounds vs. Kilograms handout. Again, students should first compare a pound to a kilogram without using a balance. Observe how students make this comparison: some may use their hands as a balance scale. When using the actual balance scale, they should discover that
   - 1 kilogram is a little more than 2 pounds.
5. After they have finished their work at both stations, gather students together to discuss the results of these comparisons. Add these ballpark comparisons to the Ballpark Comparisons for Measurement chart.

Activity 3: Volume

1. Display an empty liter bottle and an empty quart bottle with the full-line of each clearly marked. Identify the unit of measurement of each bottle. Ask students to discuss with partners whether the two bottles hold the same amount or whether one holds more than the other. Ask students to make predictions, writing them on the board for future reference.
2. Fill the liter bottle up to its full-line with dry rice (or water). Ask partners to discuss what will happen when you pour the rice from the liter bottle into the quart bottle. Have students share their thoughts.
3. Set the quart bottle on a shallow tray to catch spillage, and pour the rice from the liter bottle into the quart bottle, using a funnel. The rice should overflow the quart bottle or at least fill it well above its full-line.
4. Review the definition of the term *volume.* Ask students which bottle has a greater volume, and have them explain how they know this. Discuss how the results of the experiment compare to their predictions. Have students consider the amount of rice that went above the quart line and use this amount to compare a quart to a liter. They should discover that
   - 1 quart is a little less than 1 liter (or 1 liter is a little more than 1 quart).
5. Add these ballpark comparisons to the Ballpark Comparisons for Measurement chart.

Activity 4: Temperature

Prior to the activity, create eight temperature cards, each labeled with one of the following temperatures: 0°C, 32°F, 100°C, 212°F, 37°C, 98°F, 22°C, or 72°F. Also, draw on chart paper a chart similar to the following:

Temperatures		
	Fahrenheit	Celsius
Normal body temperature		
Average room temperature		
Water freezing temperature		
Water boiling temperature		

1. Ask students to name the units for measuring temperature. Write the terms *Fahrenheit* and *Celsius* on the board, and remind students that Fahrenheit is the unit used to measure

temperature within the U.S. Customary system and that Celsius is the unit used within the metric system. Ask students which unit they use most often.

2. Display the eight temperature cards, and ask students to tell you where to place each card on the temperatures chart. Prompt them to think about familiar temperatures to help them decide where to place the cards. You might use the following prompts:
   - Think about temperatures involved with having a fever. What temperature indicates a low fever? What temperature indicates a high fever? Using this information, consult with a partner to predict which Fahrenheit temperature is about normal body temperature. (about 98°F) Where should we place this temperature on the chart?
   - Think about the temperature inside your house. What is the normal room temperature in Fahrenheit in winter? (about 68°F) In summer? (about 76°F) Using this information, consult with your partner to predict which Fahrenheit temperature is about *average* room temperature. (72°F) Where should we place this temperature on the chart?
   - Now, think about Celsius temperatures for normal body temperature and average room temperature. You already know that Celsius temperatures are lower numbers than equivalent Fahrenheit temperatures. You also know that normal body temperature is much higher than average room temperature. Using this information, consult with your partner to predict which Celsius temperature is about normal body temperature and which is about average room temperature. Where should we place these temperatures on the chart?
   - Does anyone know the Fahrenheit or Celsius temperature at which water freezes? (If nobody knows, place one of the temperature cards on the chart.) Does anyone know the Fahrenheit or Celsius temperature at which water boils? (Again, place a card if no one knows.)
3. Have students place any remaining temperature cards. Thinking about what they learned about how Celsius temperatures compare to Fahrenheit temperatures, students should discover the following:
   - 37°C is about 98°F (about normal body temperature).
   - 22°C is about 72°F (about average room temperature).
   - 0°C is about 32°F (water freezing temperature).
   - 100°C is about 212°F (water boiling temperature).
4. Add these ballpark comparisons to the Ballpark Comparisons for Measurement chart.

Assessment

- **Questions**
  - How can ballpark measurements help us when measuring?
  - Why is it important to estimate when measuring?
  - How do you determine which units of measurement to use in different situations?
- **Journal/Writing Prompts**
  - Create a problem that involves the need to measure length, weight/mass, volume, or temperature. Explain what tool you would use to solve this problem and how you chose this tool.
  - Explain how knowing ballpark measurements can help you when measuring.

  - Describe at least three situations in which a ballpark comparison would be helpful. For each situation, explain why the ballpark comparison would be helpful.
  - Pick at least two ballpark comparisons. Describe how they compare and how you can prove they compare in that way.
  - Describe at least two benchmarks you can use to help you measure and how they can help you make an estimate.
- **Other**
  - Use any of the recording sheets as an assessment.
  - Observe students during the activity to verify appropriate use of measuring tools.
  - Create similar handouts to those used in this lesson. Ask students to estimate measurements of objects found inside their homes, using benchmarks (e.g., a paper clip could be used instead of a gram unit).

Extensions and Connections (for all students)

- Invite a chemist or a pharmacist to explain the importance of measuring volumes accurately and exactly.
- Take a field trip to a local bakery or restaurant to observe and discuss the importance of accurate and exact measurements in recipes.
- Invite a contractor to discuss the importance of measurement when building a home or business.

Strategies for Differentiation

- Develop heterogeneous ability groups of four students each for Activities 1 and 2 of this lesson in order to provide students with a mixed learning environment. Assign each student a role (e.g., classroom object selector, measurer, estimator, recorder). Consider rotating student roles.
- Develop student pairs for completion of all collaborative work in these activities.

Measuring Length

Name _____ **Date** _____

U.S. Customary System		
Tool	**Unit**	**Real-Life Use**

Metric system		
Tool	**Unit**	**Real-Life Use**

Measuring Length: Ballpark Comparisons

Name _____ **Date** _____

Comparing Inches to Centimeters		
Object in Classroom	**Measurement in Inches (in.)**	**Measurement in Centimeters (cm)**

Which unit is larger, an inch or a centimeter? _____ How do you know?

1 inch is about _____ centimeters.

Comparing Feet to Centimeters		
Object in classroom	**Measurement in Feet (ft.)**	**Measurement in Centimeters (cm)**

Which unit is smaller, a foot or a centimeter? _____ How do you know?

1 foot is about _____ centimeters.

Comparing Yards to Meters		
Object in classroom	**Measurement in Yards (yd.)**	**Measurement in Meters (m)**

How does a yard compare to a meter? _____ How do you know?

One meter is _____ than a yard.

Comparing Miles to Kilometers		
Object in classroom	**Measurement in Miles (mi.)**	**Measurement in Kilometers (km)**

How does a mile compare to a kilometer? _____ How do you know?

One mile is slightly farther than _____ kilometers.

One kilometer is slightly farther than _____ mile.

Measuring Weight/Mass: Ounces vs. Grams

Name _____ **Date** _____

1. **Compare a gram to an ounce.**
   Which is heavier, a gram or an ounce?

   About how much heavier?

   How do you know?

2. **Use the balance scale to find out how many grams it takes to equal one ounce.**
   About how many grams does it take to equal one ounce?

   How did you know when to stop adding grams?

   Why is it helpful to know the ballpark comparison between grams and ounces?

3. **Use the balance scale to measure the mass of a nickel and a paper clip.**
   About how much does a paper clip weigh?

   About how much does a nickel weigh?

   Why is it helpful to know how much a nickel and a paper clip weigh?

Measuring Weight/Mass: Pounds vs. Kilograms

Name _____ **Date** _____

1. **Compare a kilogram to a pound.**
   Which is heavier, a kilogram or a pound?

   About how much heavier?

   How do you know?

2. **Use the balance scale to find out how many pounds it takes to equal one kilogram.**
   About how many pounds does it take to equal one kilogram?

   How did you know when to stop adding pounds?

   Why is it helpful to know the ballpark comparison between pounds and kilograms?