

**Cluster 9: Using place value to understand metric measurement**

**Duration:** 2-3 weeks

**Content Standards:**

This list includes standards that will be addressed in this cluster, but not necessarily mastered, since all standards are benchmarks for the end of the year. Please note strikethroughs and recommendations in the Important Considerations section for more information.

**Solve problems involving measurement.**

**NC.4.MD.1**

Know the relative sizes of measurement units. Solve problems involving metric measurement.

- Measure to solve problems involving metric units: centimeter, meter, gram, kilogram, liter, milliliter.
- Add, subtract, multiply, and divide to solve one-step word problems involving whole-number measurements of length, mass, and capacity that are given in metric units.

**NC.4.MD. 2**

Use multiplicative reasoning to convert metric meters from a larger unit to a smaller unit using place value understanding, two-column tables, and length models.

**NC.4.MD.8**

Solve word problems involving addition and subtraction of time intervals that cross the hour.

**NC.4.NF.6**

Use decimal notation to represent fractions (second two bullets only)

**NC.4.NF.7**

Compare two decimals to hundredths by reasoning about their size using area and length models, and recording the results of comparisons with the symbols  $>$ ,  $=$ , or  $<$ . Recognize that comparisons are valid only when the two decimals refer to the same whole.

**NC.4.OA.5**

Generate and analyze a number ~~or shape pattern~~ that follows a given rule.

**Supporting standards:**

**NC.4.MD.3**

Solve problems with area and perimeter.

- Find areas of rectilinear figures with known side lengths.
- Solve problems involving a fixed area and varying perimeters with a fixed perimeter and varying areas.
- Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

**NC.4.MD.4**

Represent and interpret data using whole numbers.

- Collect data by asking a question that yields numerical data.
- Make a representation of data and interpret data in a frequency table, scaled bar graph, and/or line plot.
- ~~Determine whether a survey question will yield categorical or numerical data.~~

**Mathematical Practices:**

- 1. Make sense of problems and persevere in solving them**
- 2. Reason abstractly and quantitatively.**
3. Construct viable arguments and critique the reasoning of others
- 4. Model with mathematics**
5. Use appropriate tools strategically
6. Attend to precision
- 7. Look for and make use of structure**
- 8. Look for and express regularity in repeated reasoning.**

**What is the mathematics?**

In this cluster, students explore metric measurement for length, volume, and mass to develop a sense of the value of the different metric units. Students continue to build on the patterns and relationships when you multiply by 10 and 100 that were noticed when unpacking the place value system in Cluster 3. They apply their knowledge of multiplicative comparison to make sense of tenths and hundredths in the place value system and to convert from one metric unit to another using a conversion table. They work within the contexts of real-world data collection and measurement to represent and compare decimals.

- Students engage in multiple experiences measuring length, mass, and volume to gain a sense of the value of metric units (ex. About how much is a decimeter, a centimeter, a millimeter, a gram, a kilogram, a liter, a milliliter? Find ten objects in the room less than a decimeter strip and ten things more than a decimeter; How much space does a kilogram of cotton balls take up? A kilogram of dry beans? How many meters long is the hallway, school walking path?).
- As students measure and explore, they make estimates, assess the reasonableness of those estimates during the process of measuring and make adjustments.
- Students continue to build their understanding of multiplicative comparison and place value by measuring the same objects with different units and noticing the patterns in their measurements as ten times more or ten times less than the next unit (ex. The length of our table is 2 meters, 20 decimeters, 200 centimeters, 2000 millimeters.).
- Students generate and analyze number patterns in tables to support conversions among units (ex. One liter is the same value as 1,000 milliliters; two liters is the same value as 2,000 milliliters; three liters is the same value as 3,000 milliliters. How many milliliters in 8 liters?).
- Students use the meter stick as a length model to further explore decimal place values (ex. Roll dice and line up base ten blocks against a meter stick to “Race to a Meter” recording centimeter cubes as hundredths and decimeter cubes as tenths.).
- Students compare decimals to hundredths using length and area models (ex. Who jumped the farthest? Whose race time was the fastest?).
- Students solve word problems within the context of measurement explorations, science experiments, real life situations using metric units (ex. What is the area of our garden bed? What is the perimeter of the carpet? How many liters of water do we need for the field trip? If we want to double the recipe, how many grams of sugar do we need?).

**Important Considerations:**

- This cluster culminates the year by extending the ideas of multiplicative comparison (Cluster 2) and place value (Cluster 3) to make sense of tenths and hundredths.
- Data collection and analysis standards from the beginning of the year (Cluster 1) can be reviewed as students collect and display their measurements (numerical data) using graphs.
- One- and two-step word problems using all four operations can be presented in the context of measurement while working within the same unit. This does not include operations with decimals which are introduced in Grade 5. This cluster wraps up Grade 4, incorporates prior

work with all four operations, and provides opportunities for two-step problem solving and place value conversations.

- When engaging in tasks and word problems, students may review the interpretation of remainders from Cluster 5 (ex. It takes 2 meters of ribbon to do the bow for each present. I have 9 meters of ribbon left. How many presents can I wrap?).
- Students use a variety of tools to explore measurements including meter sticks, meter wheels, tape measures, rulers, balance scales, spring scales, graduated cylinders, and beakers. They may also use other models (ex. a ten-stick from the base-ten blocks as a decimeter).
- Note that the decimeter is not listed in the standard as one of the units students need to know. However, it is helpful to include the decimeter as a tenth of a meter and ten times a centimeter to use as a visual model of decimal place values.
- The only work that includes conversions is from larger units to smaller units within the same system (e.g., meters to centimeters, not centimeters to meters.).
- As students are first noticing number patterns and working with conversion tables they may add multiple times recursively (down the table) to find the conversion. Encourage students to reason explicitly (across the table) to find a conversion rule.