Topic B
Measuring Weight and Liquid Volume in Metric Units

3.NBT.2, 3.MD.2

Focus Standards:	3.NBT.2	Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.
	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.
Instructional Days:	6	
Coherence -Links from:	G2–M2	Addition and Subtraction of Length Units
	G2–M3	Place Value, Counting, and Comparison of Numbers to 1000
	G3–M1	Properties of Multiplication and Division and Solving Problems with Units of 2–5 and 10
-Links to:	G4–M2	Unit Conversions and Problem Solving with Metric Measurement

Lessons 6 and 7 introduce students to metric weight measured in kilograms and grams. Students learn to use digital scales as they explore these weights. They begin by holding a kilogram weight to get a sense of its weight. Then, groups of students work with scales to add rice to clear plastic zippered bags until the bags reach a weight of 1 kilogram. Once the bags reach that weight, students decompose a kilogram using ten-frames. They understand the quantity within 1 square of the ten-frame as an estimation of 100 grams. Upon that square they overlay another ten-frame, *zooming in* to estimate 10 grams. Overlaying once more leads to 1 gram. Students relate the decomposition of a kilogram to place value and the base ten system.

Throughout this two-day exploration, students reason about the size and weight of kilograms and grams in relation to one another without moving into the abstract world of conversion. They perceive the relationship between kilograms and grams as analogous to 1 meter decomposed into 100 centimeters. They build on Grade 2 estimation skills with centimeters and meters (**2.MD.3**) using metric weight. Students use scales to measure a variety of objects and learn to estimate new weights using knowledge of previously measured items. Their work with estimation in Topic B lays a foundation for rounding to estimate in the second half of the module.

In Lesson 8, students use scales to measure the weight of objects precisely, and then use those measurements to solve one-step word problems with like units. Word problems require students to add, subtract, multiply, and divide. Students apply estimation skills from Lesson 7 to reason about their solutions.

Notice that these lessons refer to *metric weight* rather than *mass*. This choice was made based on the K–5 Geometric Measurement progressions document that accompanies the CCSSM, which suggests that elementary school students may treat mass units as weight units.[1] Technically these are not equivalent, but the units can be used side by side as long as the object being measured stays on earth.[2] If students have already been introduced to the distinction between weight and mass, it may be appropriate to use the word *mass* rather than *weight*.

In Lessons 9 and 10, students measure liquid volume in liters using beakers and the vertical number line. This experience lends itself to previewing the concept and language of rounding: Students might estimate, for example, a given quantity as *halfway* between 1 and 2 or *nearer* to 2. Students use small containers to decompose 1 liter and reason about its size. This lays a conceptual foundation for Grade 4 work with milliliters and the multiplicative relationship of metric measurement units (**4.MD.1**). In these lessons, students solve one-step word problems with like units using all four operations.

Topic B culminates in solving one-step word problems with like units. Lesson 11 presents students with mixed practice, requiring students to add, subtract, multiply, and divide to find solutions to problems involving grams, kilograms, liters, and milliliters.

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[1]Page 2 of the K–5, Geometric Measurement progression document reads, "The Standards do not differentiate between weight and mass."

[2]Page 2 of the K–5, Geometric Measurement progression document reads, "…mass is the amount of matter in an object. Weight is the force exerted on the body by gravity. On the earth's surface, the distinction is not important (on the moon, an object would have the same mass, would weight [sic] less due to the lower gravity)." To keep focused, these lessons purposefully do not introduce the distinction between weight and mass because it is not needed at this level.

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A Teaching Sequence Toward Mastery of Measuring Weight and Liquid Volume in Metric Units

Objective 1: Build and decompose a kilogram to reason about the size and weight of 1 kilogram, 100 grams, 10 grams, and 1 gram.
(Lesson 6)

Objective 2: Develop estimation strategies by reasoning about the weight in kilograms of a series of familiar objects to establish mental benchmark measures.
(Lesson 7)

Objective 3: Solve one-step word problems involving metric weights within 100 and estimate to reason about solutions.
(Lesson 8)

Objective 4: Decompose a liter to reason about the size of 1 liter, 100 milliliters, 10 milliliters, and 1 milliliter.
(Lesson 9)

Objective 5: Estimate and measure liquid volume in liters and milliliters using the vertical number line.
(Lesson 10)

Objective 6: Solve mixed word problems involving all four operations with grams, kilograms, liters, and milliliters given in the same units.
(Lesson 11)