



## Table of Contents

**GRADE 4 • MODULE 2**

## Unit Conversions and Problem Solving with Metric Measurement

<b>Module Overview</b> .....	i
Topic A: Metric Unit Conversions.....	2.A.1
Topic B: Application of Metric Unit Conversions .....	2.B.1
<b>Module Assessment</b> .....	2.S.1

## Grade 4 • Module 2

# Unit Conversions and Problem Solving with Metric Measurement

## OVERVIEW

The idea of a mixed unit shows up in varied contexts. For instance, students have become accustomed to thinking of 250 as the mixed units of 2 hundreds 5 tens. Mixed units are also used in the context of 2 hr 5 min, \$2.50, 2 km 5 m, 2' 5", and  $2\frac{5}{8}$  (hours and minutes, dollars and cents, kilometers and meters, feet and inches, ones and eighths). While the context and the units may vary greatly, there are many common threads present in any mixed unit calculation. Consider the connections and similarities between the following equalities:

2 thousands	437 ones	=	2,437 ones
2 kilometers	437 meters	=	2,437 meters
2 kilograms	437 grams	=	2,437 grams
2 liters	437 milliliters	=	2,437 milliliters

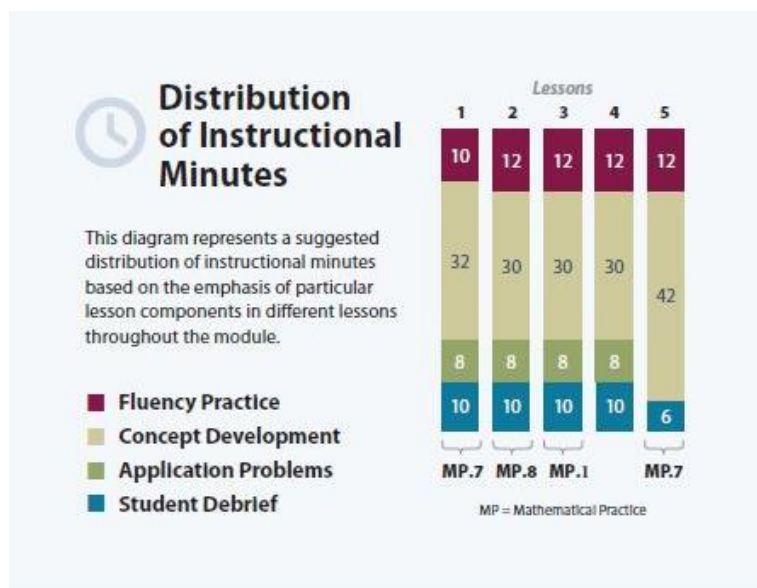
In order to explore the process of working with mixed units, Module 2 focuses on length, mass, and capacity in the metric system<sup>1</sup> where place value serves as a natural guide for moving between larger and smaller units.

In Topic A, students review place value concepts while building fluency with decomposing, or converting from larger to smaller units (**4.MD.1**). They learn the relative sizes of measurement units, building off prior knowledge of grams and kilograms from Grade 3 (**3.MD.2**) and meters and centimeters from Grade 2 (**2.MD.3**). Conversions between the units are recorded in a two-column table. Single-step problems involving addition and subtraction of metric units provide an opportunity to practice mental math calculations as well as the addition and subtraction algorithms established in Module 1. Students reason by choosing to convert between mixed and single units before or after the computation (**4.MD.2**). Connecting their familiarity with both metric units and place value, the module moves swiftly through each unit of conversion, spending only one day on each type. This initial understanding of unit conversions allows for further application and practice, such as multiplying and dividing metric units, throughout subsequent modules.

In Topic B, students continue to build off of their measurement work from previous grade levels. They solidify their understanding of the relationship between metric units and the place value chart and apply unit conversions to solve and reason about multi-step word problems (**4.MD.2**). Applying the skills learned in Module 1, students discover and explore the relationship between place value and conversions. The beauty of both the place value and measurement systems is the efficiency and precision permitted by the use of different size units to express a given quantity. As students solve word problems by adding and subtracting

<sup>1</sup> Pounds, ounces, time, and money are covered in Module 7.

metric units, their ability to reason in parts and wholes is taken to the next level. This is important preparation for multi-digit operations and for manipulating fractional units in future modules. Tape diagrams and number lines serve as models throughout the module to support the application of the standard algorithm to word problems.



## Focus Grade Level Standards

**Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.<sup>2</sup>**

**4.MD.1<sup>3</sup>** 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<sup>4</sup>** 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.

<sup>2</sup> 4.MD.3 is addressed in Module 3.

<sup>3</sup> Pounds, ounces, and time are addressed in Module 7. This is a non-tested standard, but expressing metric measurements of length, mass, and capacity from larger to smaller units strengthens the upcoming modules.

<sup>4</sup> Time and money are addressed in Module 7. This is a non-tested standard, but the contexts of operating on distance, volume, and mass strengthen the upcoming modules.

## Foundational Standards

- 2.NBT.1** Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special case:
- a. 100 can be thought of as a bundle of ten tens—called a “hundred.”
- 2.MD.5** Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.
- 3.MD.2** Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (L). (Excludes compound units such as  $\text{cm}^3$  and finding the geometric volume of a container.) 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. (Excludes multiplicative comparison problems, i.e., problems involving notions of “times as much.”)
- 4.OA.3** Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
- 4.NBT.4** Fluently add and subtract multi-digit whole numbers using the standard algorithm.

## Focus Standards for Mathematical Practice

- MP.1** **Make sense of problems and persevere in solving them.** Students use place value knowledge to convert larger units to smaller units before adding and subtracting. They fluently add and subtract metric units of length, weight, and capacity using the standard algorithm. Tape diagrams and number lines help students conceptualize a problem before it is solved and are used to assess the reasonableness of an answer.
- MP.7** **Look for and make use of structure.** Students use knowledge of place value and mixed units to find patterns when converting from a larger unit to a smaller unit. They recognize that 1 thousand equals 1,000 ones and relate that to 1 kilometer equals 1,000 meters. Using this pattern, they might extend thinking to convert smaller to larger units when making a conversion chart.
- MP.8** **Look for and express regularity in repeated reasoning.** Students find that metric unit conversions share a relationship on the place value chart. For example, 1,000 ones equals 1 thousand, 1,000 g equals 1 kg, 1,000 mL equals 1 L, and 1,000 m equals 1 km. Knowing and using these conversions and similarities allows for quick and easy conversion and calculation.

## Overview of Module Topics and Lesson Objectives

Standards	Topics and Objectives	Days
4.MD.1 4.MD.2	<b>A Metric Unit Conversions</b> Lesson 1: Express metric length measurements in terms of a smaller unit; model and solve addition and subtraction word problems involving metric length. Lesson 2: Express metric mass measurements in terms of a smaller unit; model and solve addition and subtraction word problems involving metric mass. Lesson 3: Express metric capacity measurements in terms of a smaller unit; model and solve addition and subtraction word problems involving metric capacity.	3
4.MD.1 4.MD.2	<b>B Application of Metric Unit Conversions</b> Lesson 4: Know and relate metric units to place value units in order to express measurements in different units. Lesson 5: Use addition and subtraction to solve multi-step word problems involving length, mass, and capacity.	2
	End-of-Module Assessment: Topics A–B (assessment $\frac{1}{2}$ day, return $\frac{1}{2}$ day, remediation or further applications 1 day)	2
<b>Total Number of Instructional Days</b>		<b>7</b>

## Terminology

### New or Recently Introduced Terms

- Convert (express a measurement in a different unit; rename units)
- Kilometer (km, a unit of measure for length)
- Mass (the measure of the amount of matter in an object)
- Milliliter (mL, a unit of measure for liquid volume)
- Mixed units (e.g., 3 m 43 cm)

## Familiar Terms and Symbols<sup>5</sup>

- $=, <, >$  (equal to, less than, greater than)
- Algorithm ( a step-by-step procedure to solve a particular type of problem)
- Capacity (the maximum amount that something can contain)
- Distance (the length of the line segment joining two points)
- Equivalent (equal)
- Kilogram (kg), gram (g) (units of measure for mass)
- Larger or smaller unit (used in a comparison of units)
- Length (the measurement of something from end to end)
- Liter (L) (unit of measure for liquid volume)
- Measurement (dimensions, quantity, or capacity as determined by comparison with a standard)
- Meter (m), centimeter (cm) (units of measure for length)
- Mixed units (e.g., 2 tens 4 ones, 2 kilometers 34 meters)
- Simplifying strategy (a mental math or recorded method for making a problem easier to solve)
- Table (used to represent data)
- Times as much as (e.g., 1 hundred is 10 times as much as 1 ten)
- Weight (the measurement of how heavy something is)

## Suggested Tools and Representations

- Balance scale, weights (masses)
- Centimeter ruler, meter stick
- Liter containers with millimeter scale
- Number line
- Tape diagram
- Two-column table

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<sup>5</sup> These are terms and symbols students have used or seen previously.

## Scaffolds<sup>6</sup>

The scaffolds integrated into *A Story of Units* give alternatives for how students access information as well as express and demonstrate their learning. Strategically placed margin notes are provided within each lesson elaborating on the use of specific scaffolds at applicable times. They address many needs presented by English language learners, students with disabilities, students performing above grade level, and students performing below grade level. Many of the suggestions are organized by Universal Design for Learning (UDL) principles and are applicable to more than one population. To read more about the approach to differentiated instruction in *A Story of Units*, please refer to “How to Implement *A Story of Units*.”

## Assessment Summary

Type	Administered	Format	Standards Addressed
End-of-Module Assessment Task	After Topic B	Constructed response with rubric	4.MD.1 4.MD.2

<sup>6</sup> Students with disabilities may require Braille, large print, audio, or special digital files. Please visit the website [www.p12.nysed.gov/specialed/aim](http://www.p12.nysed.gov/specialed/aim) for specific information on how to obtain student materials that satisfy the National Instructional Materials Accessibility Standard (NIMAS) format.