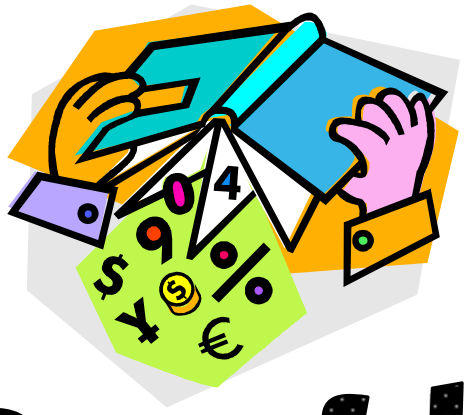
Mathematics:



"A Story of Units"

Parent Handbook

Grade 4

Module 2

Grade 4• Module 2

Unit Conversions and Problem Solving with Metric Measurement

OVERVIEW

Students have become accustomed to thinking of 250 as 2 hundreds 5 tens, but the idea of a mixed unit shows up in many varied contexts, such as 2 hr 5 min, $2.50, 2 km 5 m, 2’ 5”, 2 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:

	2,437	→	2 thousands 437 ones	=	2,437 ones
2 km 437 m	2,437 m	→	2 kilometers 437 meters	=	2,437 meters
2 kg 437 g	2,437 g	→	2 kilograms 437 grams	=	2,437 grams
2 L 437 mL	2,437 mL	→	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, 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 to decompose or convert from larger to smaller units. They learn the relative sizes of measurement units, building off prior knowledge of grams, kilograms, meters, and centimeters. As students progress through the topics, they reason about correct unit sizes and use diagrams such as number lines with measurement scales to represent problems. Conversions between the units are recorded in a two-column table. Addition and subtraction single-step problems of metric units provides an opportunity to practice mental math calculations as well as solve using 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. Connecting their familiarity of 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 will allow for further application and practice throughout subsequent modules, such as when multiplying and dividing metric units.

In Topic B, students again build off of their measurement work from previous grade levels, 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. Applying the skills learned in Module 1, students discover and explore the relationship between place value and conversions. The beauty both of our 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 metric units, their ability to reason in parts and wholes is taken to the next level, which is important preparation for multi-digit operations and for manipulating fractional units in future modules. Tape diagrams and number lines will serve as models throughout to support applying the standard algorithm to word problems.

Terminology

New or Recently Introduced Terms

- 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

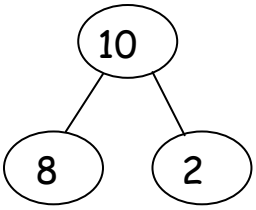
- =, <, > (equal, less than, greater than)
- Capacity (the maximum amount that something can contain)
- Convert (to express a measurement in a different unit)
- Distance (the length of the line segment joining two points)
- Equivalent (equal)
- Estimate (an approximation of the value of a number or quantity)
- 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)
- Table (used to represent data)
- Weight (the measurement of how heavy something is)

Suggested Tools and Representations

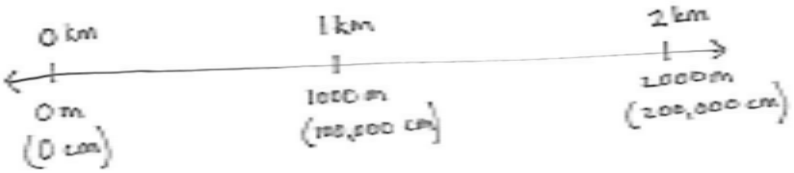
- Beakers or liter container
- Number line
- Ruler, meter stick, measuring tape
- Scale, weights (masses)
- Tape diagrams

**The sample questions/responses contained in this manual are straight from http://www.engageny.org/. They are provided to give some insight into the kinds of skills expected of students as the lesson is taught.

Number Bond: This bond is showing that the addends or parts, 8 and 2, together total the sum, 10.



Number Line: The number line is used to develop a deeper understanding of whole number units, fraction units, measurement units, decimals, and negative numbers. Throughout Grades K-5, the number line models measuring units.



Tape Diagram: Tape diagrams, also called bar models, are pictorial representations of relationships between quantities used to solve word problems. At the heart of a tape diagram is the idea of *forming units*. In fact, forming units to solve word problems is one of the most powerful examples of the unit theme and is particularly helpful for understanding fraction arithmetic.

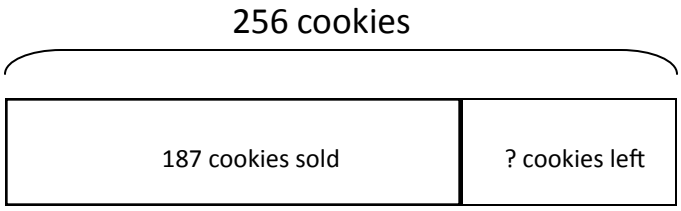
The tape diagram provides an essential bridge to algebra and is often called “pictorial algebra.” There are two basic forms of the tape diagram model. The first form is sometimes called the part-whole model; it uses bar segments placed end-to-end (Grade 3 Example on next page), while the second form, sometimes called the comparison model, uses two or more bars stacked in rows that are typically left justified. (Grade 5 Example, on next page, depicts this model.)

Tape Diagram (continued):

Grade 3 Example:

Sarah baked 256 cookies. She sold some of them. 187 were left. How many did she sell?

256 – 187 = _____

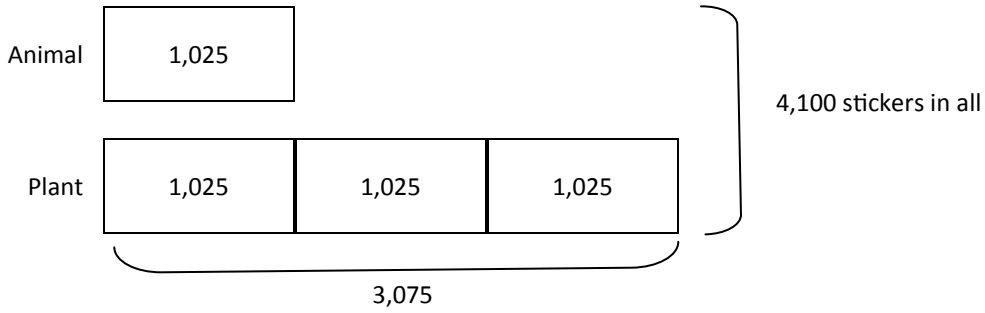


256 –187 = 69

Sarah sold 69 cookies.

Grade 5 Example:

Sam has 1,025 animal stickers. He has 3 times as many plant stickers as animal stickers. How many plant stickers does Sam have? How many stickers does Sam have altogether?



1. He has 3,075 plant stickers.

2. He has 4,100 stickers altogether.

Lesson 1

Objective: Express metric length measurements in terms of a smaller unit; model and solve addition and subtraction word problems involving metric length.

2. Find the equivalent measures.

a. 3 km 312 m = 3,312 m

b. 13 km 27 m = 13,027 m

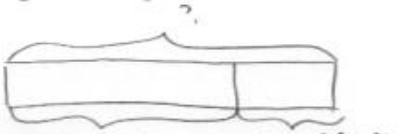
c. 915 km 8 m = 915,008 m

c) Express your answer in the smaller of the two units:

1 km 431 m + 13 km 169 m = 14,600 m

1,431 m
+ 13,169 m
14,600

4. The length of Carter's driveway is 12m 38cm. His neighbor's driveway is 4m 99cm longer. How long is the neighbor's driveway?



12m 38cm
+ 4m 99cm
16m 137 cm
1m 37cm

The neighbor's driveway is 17m 37 cm long.

Lesson 2

Objective: Express metric mass measurements in terms of a smaller unit; model and solve addition and subtraction word problems involving metric mass.

2. Find the equivalent measures.

a. 1 kg 500 g = 1,500 g

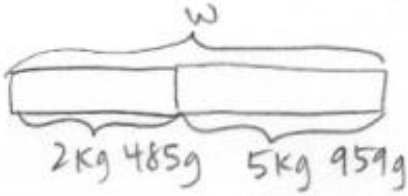
b. 3 kg 715 g = 3,715 g

e) Express the answer in mixed units:

14 kg 505 g – 4,288 g = 10 kg 217 g

4,915
14 kg ~~505~~ g
– 4 kg 288 g
10 kg 217 g

4. One package weighs 2kg 485 g. Another package weighs 5 kg 959g. What is the total weight of the two packages?



2 kg 485g
+ 5 kg 959 g
7 kg 1444 g
1kg 444g

The total weight of the two packages is 8 kg 444 g

Lesson 3

Objective: Express metric capacity measurements in terms of a smaller unit; model and solve addition and subtraction word problems involving metric capacity.

2. Find the missing numbers.

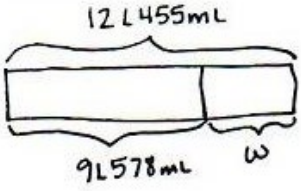
a. 2 L 500 mL = 2,500 mL

b. 70 L 850 mL = 70,850 mL

a. 1,760 mL + 40 L = 41 L 760 mL

1 L 760 mL

6. Petra's fish tank contains 9 liters 578 milliliters of water. If the tank can hold 12 liters 455 milliliters of water, how many more milliliters of water does she need to fill the tank?



13 14
1 3 4 15
12,455 mL
- 9,578 mL
2,877 mL

She needs 2,877 more milliliters of water.

Lesson 4

Objective: Know and relate metric units to place value in order to express measurements in different units.

2. Fill in the units in word form.

a. 429 is 4 hundreds 29 ones.

c. 2,456 is 2 thousands 456 ones.

5. Compare using >, <, or =.

a. 893,503 mL (>) 89 L 353 mL

893 L 503 mL

b. 410 km 3 m (>) 4,103 m

4 km 103 m

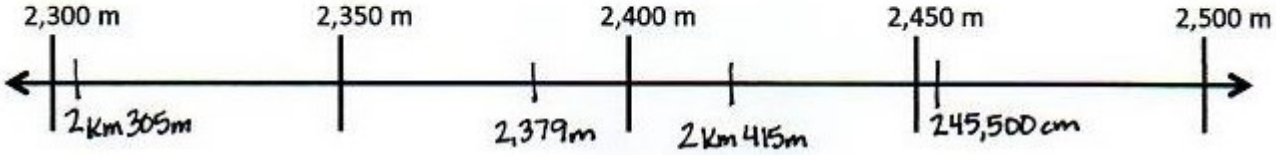
6. Place the following measurements on the number line:

2 km 415 m
2,415 m

2,379 m

2 km 305 m
2,305 m

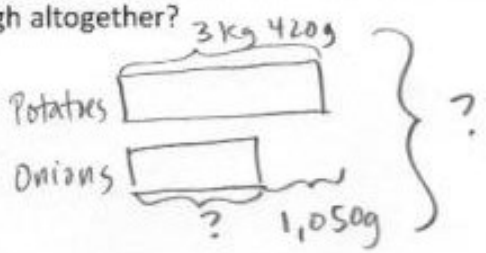
245,500 cm
2,455 m



Lesson 5

Objective: Use addition and subtraction to solve multi-step word problems involving length, mass, and capacity.

1. The potatoes Beth bought weighed 3 kilograms 420 grams. Her onions weighed 1050g less than the potatoes. How much did the potatoes and onions weigh altogether?



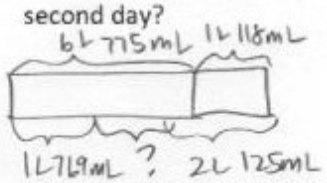
3kg 420g = 3,420g

$$\begin{array}{r} 3,\overset{3}{4}\overset{12}{2}0\text{g} \\ -\ 1,050\text{g} \\ \hline 2,370\text{g} \end{array}$$

$$\begin{array}{r} 3,420\text{g} \\ +\ 2,370\text{g} \\ \hline 5,790\text{g} \end{array}$$

The potatoes and onions weighed 5,790g or 5kg 790g altogether.

3. Shyan's barrel contained 6 liters 775 milliliters of paint. She poured in 1 liters 118 milliliters more. The first day Shyan used 2 liters 125 milliliters of the paint. At the end of the second day, there was 1 liters 769 milliliters of paint remaining in the barrel. How much paint did Shyan use on the second day?



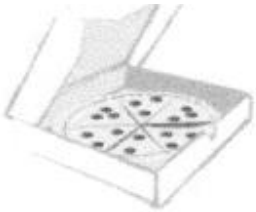
$$\begin{array}{r} 6\text{L}\ 775\text{mL} \\ +\ 1\text{L}\ 118\text{mL} \\ \hline 7\text{L}\ 893\text{mL} \end{array}$$

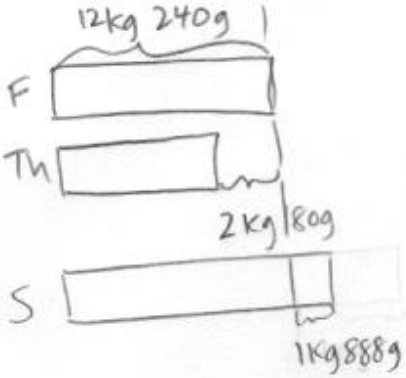
$$\begin{array}{r} 7\text{L}\ \overset{8}{8}\overset{13}{9}3\text{mL} \\ -\ 2\text{L}\ 125\text{mL} \\ \hline 5\text{L}\ 768\text{mL} \end{array}$$

$$\begin{array}{r} \overset{4}{\cancel{5}}\text{L}\ \overset{6}{\cancel{7}}\overset{15}{\cancel{6}}8\text{mL} \\ -\ 1\text{L}\ 769\text{mL} \\ \hline 3\text{L}\ 999\text{mL} \end{array}$$

On the second day, Shyan used 3L 999mL of paint.

4. On Thursday, the pizzeria used 2 kilograms 180 grams less flour than they used on Friday. On Friday, they used 12 kilograms 240 grams. On Saturday, they used 1 kilograms 888 grams more than on Friday. What was the total amount of flour used over the three days?





$$\begin{array}{r} 12\text{kg}\ \overset{1}{\overset{14}{\cancel{2}}}\overset{14}{\cancel{4}}0\text{g} \\ -\ 2\text{kg}\ 180\text{g} \\ \hline 10\text{kg}\ 60\text{g} \end{array}$$

$$\begin{array}{r} 12\text{kg}\ 240\text{g} \\ +\ 1\text{kg}\ 888\text{g} \\ \hline 14\text{kg}\ 128\text{g} \end{array}$$

$$\begin{array}{r} 12\text{kg}\ 240\text{g} \\ 10\text{kg}\ 60\text{g} \\ +\ 14\text{kg}\ 128\text{g} \\ \hline 36\text{kg}\ 428\text{g} \end{array}$$

Over the 3 days, the pizzeria used 36kg 428g of flour.