

Kenmore-Town of Tonawanda UFSD

We educate, prepare, and inspire all students to achieve their highest potential



Grade 4 Module 2 Parent Handbook

Unit Conversions and Problem Solving with Metric Measurement

In Module 2, we use length, mass, and capacity in the metric system to convert between units using place value knowledge. We will explore the patterns in the place value system through metric unit conversions, and will use mixed unit conversions to prepare for fraction and decimal operations to come.

Mass	
kg	g
1	1,000
6	
	6,000
15	
	15,000
100	

A typical fill-in-the-blank conversion table in Module 2

Metric Units of Length		
Centimeter	meter	Kilometer
length of shoe	height of counter-top	distance from the school to the train station

Learning real-life representations of metric units is an important part of internalizing and understanding metric conversions.

What Came Before this Module:

Students deepened their understanding of the patterns in the place value system by working with numbers up to one million.

What Comes After this Module:

In Module 3, students start with applying multiplication and division to contexts such as area and perimeter to set the stage for multiplication and division of multi-digit whole numbers.

Key Words to Know

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

Capacity: the maximum amount that something can contain

Convert: to express a measurement in a different unit

Kilogram (kg), gram (g): units of measure for mass

Length: the measurement of something from end to end

Liter: (L) unit of measure for liquid volume

Meter (m), centimeter (cm): units of measure for length

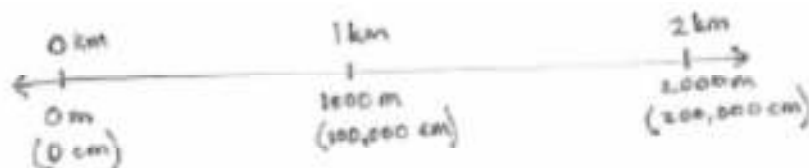
Weight: the measurement of how heavy something is

+ How you can help at home:

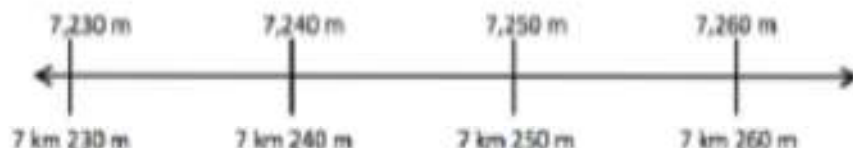
- If you have metric measurement tools at home, encourage your student to measure objects around the house
- Continue to talk about place value patterns with your student, e.g. how many 10s in 100? How many 100s in 1000?
- Review the vocabulary words in this unit, especially the new metric measurement words

Key Common Core Standards:

- *Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit*
 - Know relative sizes of measurement units within one system of units including kilometer (km), meter (m), centimeter (cm); kilogram (kg), gram (g); pound (lb), ounce (oz); liter (l), milliliter (ml); hour (hr), minute (min), second (sec). Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.
 - Use the four operations to solve word problems involving distances, liquid volumes, and masses of objects. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.



(Above) A number line from Module 2 showing multiple metric conversions



(Above) A number line from Module 2 showing both single unit and mixed unit numbers

Spotlight on Math Models:

Number Lines

You will often see this mathematical representation in A Story of Units.

A Story of Units has several key mathematical “models” that are used throughout a student’s elementary years.

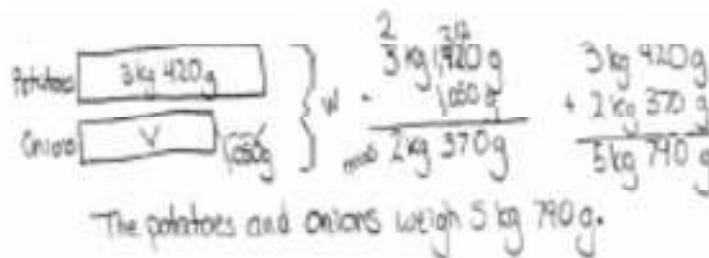
The number line is a powerful, flexible model that students can use in many ways. In this particular module, students use the number line to mark off regular intervals for the metric units they are working with. Typically number lines show one set of units, such as ones (1, 2, 3, 4...13, 14, 15) but number lines can list two different sets of units showing equivalencies to aid in converting. When students label both sets of units, it helps reinforce the equivalencies and conversion rates between units (see above).

As students move through the grades, number lines can be used to examine the relationships between numbers in ever more detailed ways, including decimals, fractions, and eventually positive and negative numbers. See how many number lines you and your student can spot around your home!

Sample Problem from Module 2:
(Example taken from Module 2, Lesson 3)

The potatoes Beth bought weighed 3 kilograms 420 grams. Her onions weighed 1,050 grams less than the potatoes.

How much did the potatoes and onions weigh together?



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 258 (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 system¹ 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 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.

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

- =, <, > (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

Grade 4 Module 2 Topic A

Metric Unit Conversions

Focus Standards:

- 4.MD.1 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 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.

Instructional Days Recommended: 3

In order to explore the process of working with mixed units, Module 2 focuses on length, mass, and capacity in the metric system,³ 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, beginning in Lesson 1. Recording the unit conversions in a table allows students to notice patterns when converting from a smaller unit to a larger unit (e.g., 200 centimeters is the same as 2 meters because 1 meter is equal to 100 centimeters). Single-step problems involving addition and subtraction of metric units provide an opportunity to practice simplifying strategies (e.g., mental math strategies) as well as the addition and subtraction algorithm established in Module 1 (**4.NBT.4**). Students practice reasoning by choosing to convert mixed units to a single unit before or after the computation (**4.MD.2**).

$$2 \text{ km } 608 \text{ m} + 3 \text{ km } 412 \text{ m}$$

Algorithms:

$$\begin{array}{r} 2 \text{ km } 608 \text{ m} \\ + 3 \text{ km } 412 \text{ m} \\ \hline 5 \text{ km } 1020 \text{ m} \\ \quad \quad \quad \uparrow \\ \quad \quad \quad 1 \text{ km } 20 \text{ m} \\ 6 \text{ km } 20 \text{ m} = 6,020 \text{ m} \end{array}$$

or

$$\begin{array}{r} 2,608 \text{ m} \\ + 3,412 \text{ m} \\ \hline 6,020 \text{ m} = 6 \text{ km } 20 \text{ m} \end{array}$$

Simplifying Strategies:

$$\begin{aligned} 2 \text{ km} + 3 \text{ km} &= 5 \text{ km} \\ 608 \text{ m} + 412 \text{ m} &= 600 \text{ m} + 420 \text{ m} \\ &= 1,020 \text{ m} \\ 5 \text{ km} + 1 \text{ km } 20 \text{ m} &= 6 \text{ km } 20 \text{ m} \end{aligned}$$

or

$$\begin{array}{r} 2,608 \text{ m} + 3,412 \text{ m} \\ \begin{array}{l} \swarrow \quad \downarrow \quad \searrow \\ 2,000 \quad 600 \quad 8 \end{array} \quad \begin{array}{l} \swarrow \quad \downarrow \quad \searrow \\ 3,000 \quad 400 \quad 12 \end{array} \\ 5,000 \text{ m} + 1,000 \text{ m} + 20 \text{ m} = 6,020 \text{ m} \end{array}$$

Word problems provide a context in which to apply the conversions and include the addition and subtraction of mixed units. Connecting students' familiarity with both metric units and place value, the module moves swiftly through each unit of conversion, spending only one day on each type of measurement. This initial understanding of unit conversions allows for further application and practice, such as when multiplying and dividing metric units, throughout subsequent modules.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 1

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

Homework Key

- 5,000
 - 13,000
 - 17
 - 60,000
 - 700
 - 1,900
 - 24
 - 9,000
- 7,123
 - 22,022
 - 875,004
 - 745
 - 6,707
 - 20,489
- 1,747 m or 1 km 747 m
 - 146 cm or 1 m 46 cm
 - 400,924 m
 - 64,586 cm
 - 177,555 m or 177 km 555 m
 - 717,640 m or 717 km 640 m
- 1,822 cm or 18 m 22 cm
- 6,710 m or 6 km 710 m
- 647 m
- 172 cm

Work Samples

1. Find the equivalent measures.

a. 5 km = <u>5,000</u> m	e. 7 m = <u>700</u> cm
b. 13 km = <u>13,000</u> m	f. 19 m = <u>1,900</u> cm
c. <u>17</u> km = 17,000 m	g. <u>24</u> m = 2,400 cm
d. 60 km = <u>60,000</u> m	h. 90 m = <u>9,000</u> cm

Handwritten note: Think, 1 km = 1,000 m

Lesson 2

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

Homework Key

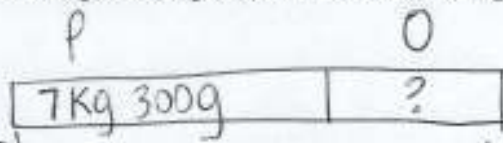
- 6,000; 8; 15,000; 24; 550,000
- 2,700
 - 5,945
 - 29,058
 - 31,003
 - 66; 597
 - 270,041
- 450g
 - 4,270g or 4kg 270g
 - 28,241g
 - 18,800g
 - 3kg 874g
 - 52kg 239g
- 49,224g or 49 kg 224g
- 3,715g or 3kg 715g
- 1,879g or 1 kg 879g

Work Samples

- Complete the conversion table.

Mass	
kg	g
1	1,000
6	6,000
8	8,000
15	15,000
24	24,000
550	550,000

5. A bag of potatoes and a bag of onions combined weigh 11 kilograms 15 grams. If the bag of potatoes weighs 7 kilograms 300 grams, how much does the bag of onions weigh?



$$11\text{Kg}15\text{g} = 7\text{Kg}300\text{g} + x$$

$$11,015\text{g} = 7,300\text{g} + x$$

$$11,015\text{g} - 7,300\text{g} = x$$

$$3,715\text{g} = x$$

$$3\text{Kg}715\text{g}$$

convert to same units
 $11\text{Kg}15\text{g} = 11,015\text{g}$
($1\text{Kg} = 1,000\text{g}$)

11Kg15g Potatoes + Onions

Done
/

Lesson 3

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

Homework Key

- 8,000; 27,000; 39; 68,000; 102
- a. 5,850
b. 29,303
c. 37,037 d. 30,100 mL
e. 8 L 575 mL
- a. 593 mL
b. 2,260 mL or 2 L 260 mL
c. 28,360 mL
d. 17,002
e. 13; 674
f. 12 L 779 mL f. 275; 5
- Marie's bucket
- 17,735 mL or 17 L 735 mL
- 28,657 mL or 28 L 657 mL

Homework Samples

1. Complete the conversion table.

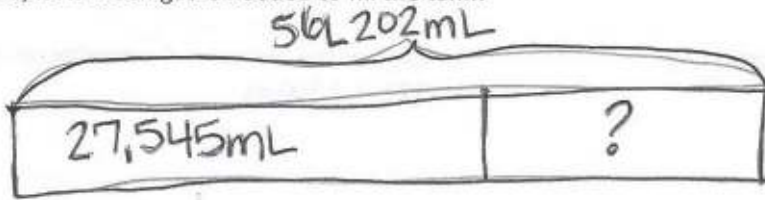
Liquid Capacity	
L	mL
1	1,000
8	8,000
27	27,000
39	39,000
68	68,000
102	102,000

2. Convert the measurements.

- 5 L 850 mL = 5,850 mL
- 29 L 303 mL = 29,303 mL
- 37 L 37 mL = 37,037 mL
- 17 L 2 mL = 17,002 mL
- 13,674 mL = 13 L 674 mL
- 275,005 mL = 275 L 5 mL

Lesson 3 (continued)

6. 27,545 milliliters of gas were added to a car's empty gas tank. If the gas tank's capacity is 56 liters 202 milliliters, how much gas is needed to fill the tank?



$$56\text{L } 202\text{mL} = 27,545\text{mL} + X$$

$$56,202\text{mL} = 27,545\text{mL} + X$$

$$56,202\text{mL} - 27,545\text{mL} = X$$

$$28,657\text{mL} = X \quad \text{or } 28\text{L } 657\text{mL}$$

Grade 4 Module 2 Topic B

Application of Metric Unit Conversions

Focus Standards:

- 4.MD.1 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 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.

Instructional Days Recommended: 2

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.

Lesson 4 connects metric measurement conversions and place value by comparing mixed units of measure and verifying statements such as “1 kilometer is 1,000 times as much as 1 meter.” In Lesson 5, as students solve two- and three-step word problems by adding and subtracting 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. Throughout Topic B, tape diagrams and number lines serve as models to support application of the standard algorithm to word problems. Students solve problems by converting between units and by using simplifying strategies or algorithms. (4.MD.1).

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 4

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

Homework Key

1. One; 1,000; kilogram; thousand; liter; 100,000
2.
 - a. Hundred
 - b. Meter
 - c. Thousand
 - d. Kilometer
 - e. Thousands
 - f. Grams
3.
 - a. 125,312
 - b. 125,312
4.
 - a. >
 - b. <
5. 28,890 g or 28 kg 890 g
6. Measurements plotted accurately on the number line
7. Measurements plotted accurately on the number line

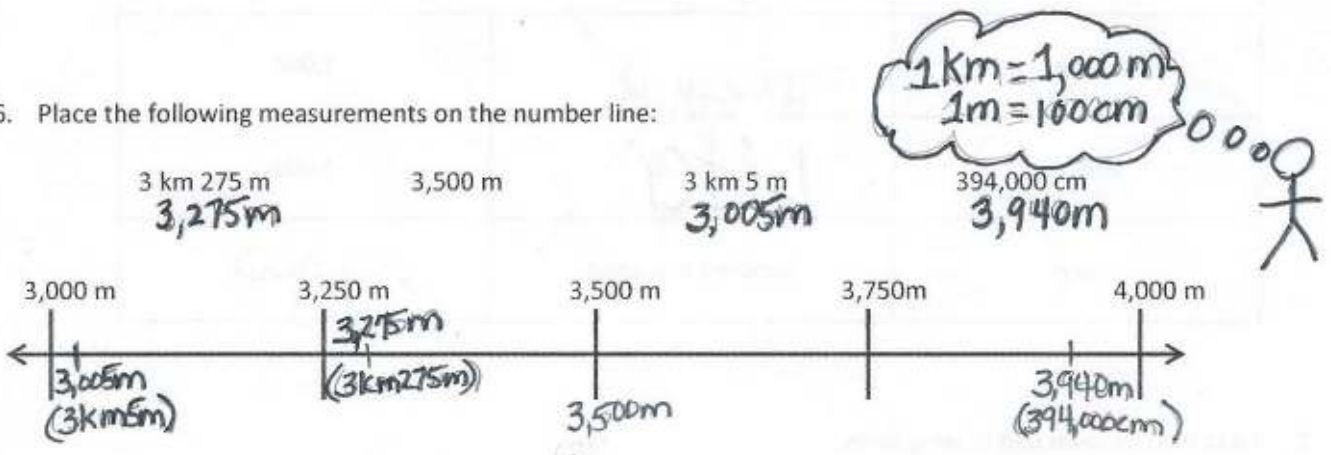
Homework Samples

1. Complete the table.

Smaller Unit	Larger Unit	How Many Times as Large as?
centimeter	meter	100
one	hundred	100
meter	kilometer	1,000
gram	Kilogram	1,000
one	thousand	1,000
milliliter	liter	1,000
one	hundred thousand	100,000

Lesson 4 (continued)

6. Place the following measurements on the number line:



Lesson 5

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

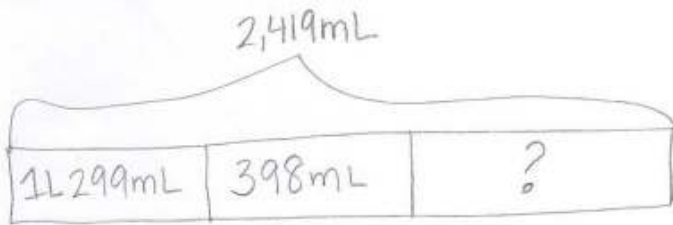
Homework Key

1. 722 mL
2. 1,875 m or 1 km 875 m
3. 29,540 g or 29 kg 540 g
4. 45,066 g
5. 13 cm
6. 182,700 mL or 182 L 700 mL

Homework Samples

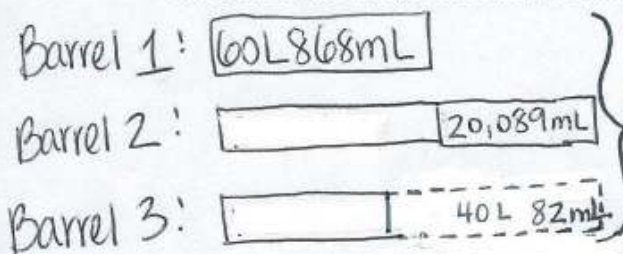
Model each problem with a tape diagram. Solve and answer with a statement.

1. The capacity of Jose's vase is 2,419 milliliters of water. He poured 1 liter 299 milliliters of water into the empty vase. Then, he added 398 milliliters. How much more water will the vase hold?



$$\begin{aligned}
 2,419 \text{ mL} &= 1\text{L} 299 \text{ mL} + 398 \text{ mL} + x \\
 2,419 \text{ mL} &= 1,299 \text{ mL} + 398 \text{ mL} + x \\
 2,419 \text{ mL} &= 1,697 \text{ mL} + x \\
 2,419 \text{ mL} - 1,697 \text{ mL} &= x \\
 722 \text{ mL} &= x
 \end{aligned}$$

6. One barrel held 60 liters 868 milliliters of sap. A second barrel held 20,089 milliliters more sap than the first. A third barrel held 40 liters 82 milliliters less sap than the second. If the sap from the three barrels was poured into a larger container, how much sap would there be in all?



$$\begin{array}{r}
 \text{Barrel 2} \\
 60,868 \text{ mL} \\
 + 20,089 \text{ mL} \\
 \hline
 80,957
 \end{array}$$

$$\begin{array}{r}
 \text{Barrel 3} \\
 80,957 \text{ mL} \\
 - 40,082 \text{ mL} \\
 \hline
 40,875 \text{ mL}
 \end{array}$$

$$\begin{aligned}
 60,868 + 80,957 + 40,875 &= 182,700 \text{ mL} \\
 &\text{or} \\
 &182 \text{ L } 700 \text{ mL}
 \end{aligned}$$