Metric Units of Mass and Liquid Volume

**Essential Question** How can you compare metric units of mass and liquid volume?

Unlock the Problem

Mass is the amount of matter in an object. Metric units of mass include kilograms (kg) and grams (g). Liters (L) and milliliters (mL) are metric units of liquid volume.

The charts show the relationship between these units.

<table>
<thead>
<tr>
<th>Metric Units of Mass</th>
<th>Metric Units of Liquid Volume</th>
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</thead>
<tbody>
<tr>
<td>1 kilogram (kg) = 1,000 grams (g)</td>
<td>1 liter (L) = 1,000 milliliters (mL)</td>
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</table>

**Example 1** Compare kilograms and grams.

Becky planted a flower garden full of bluebonnets. She used 9 kilograms of soil. How many grams of soil is that?

\[
\begin{array}{ccc}
\text{number of kilograms} & \times & \text{grams in 1 kilogram} \\
9 & \times & 1,000 \\
\end{array}
\]

So, Becky used \(9,000\) grams of soil to plant her bluebonnets.

**Example 2** Compare liters and milliliters.

Becky used 5 liters of water to water her bluebonnet garden. How many milliliters of water is that?

\[
\begin{array}{ccc}
\text{number of liters} & \times & \text{milliliters in 1 liter} \\
5 & \times & 1,000 \\
\end{array}
\]

So, Becky used \(5,000\) milliliters of water.

**Math Talk**

**Identify Relationships**

Compare the size of a kilogram to the size of a gram. Then compare the size of a liter to the size of a milliliter.
1. There are 3 liters of water in a pitcher. How many milliliters of water are in the pitcher?

There are ______ milliliters in 1 liter. Since I am changing from a larger unit to a smaller unit, I can ______ 3 by 1,000 to find the number of milliliters in 3 liters.

So, there are ______ milliliters of water in the pitcher.

2. 4 liters = ______ milliliters

3. 6 kilograms = ______ grams

4. 8 kilograms = ______ grams

5. 7 liters = ______ milliliters

6. 1 kilogram ( ) 900 grams

7. 2 liters ( ) 2,000 milliliters

8. Complete.

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<th>Liters</th>
<th>Milliliters</th>
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10. Frank wants to fill a fish tank with 8 liters of water. How many milliliters is that?

11. **GO DEEPER** Kim has 3 water bottles. She fills each bottle with 1 liter of water. How many milliliters of water does she have?

12. **GO DEEPER** Jared’s empty backpack has a mass of 3 kilograms. He doesn’t want to carry more than 7 kilograms on a trip. How many grams of equipment can Jared pack?

13. **GO DEEPER** A large cooler contains 20 liters of iced tea and a small cooler contains 5 liters of iced tea. How many more milliliters of iced tea does the large cooler contain than the small cooler?

14. **THINK SMARTER** A 500-gram bag of granola costs $4, and a 2-kilogram bag of granola costs $15. What is the least expensive way to buy 2,000 grams of granola? Explain.

15. **MATHEMATICAL PRACTICE** **Verify the Reasoning of Others** The world’s largest apple had a mass of 1,849 grams. Sue said the mass was greater than 2 kilograms. Does Sue’s statement make sense? Explain.
Unlock the Problem

16. **THINK SMARTER** Lori bought 600 grams of cayenne pepper and 2 kilograms of black pepper. How many grams of pepper did she buy in all?

a. What are you asked to find?

b. What information will you use?

c. Tell how you might solve the problem.

d. Show how you solved the problem.

e. Complete the sentences.

Lori bought ____ grams of cayenne pepper.

She bought ____ grams of black pepper.

____ + ____ = ____ grams

So, Lori bought ____ grams of pepper in all.

17. **WRITE** Math Jill has two rocks. One has a mass of 20 grams and the other has a mass of 20 kilograms. Which rock has the greater mass? Explain.

18. **THINK SMARTER** For numbers 18a–18c, choose Yes or No to tell whether the measurements are equivalent.

18a. 5,000 grams and 5 kilograms 〇 Yes 〇 No

18b. 300 milliliters and 3 liters 〇 Yes 〇 No

18c. 8 grams and 8,000 kilograms 〇 Yes 〇 No
Complete.

1. 5 liters = 5,000 milliliters

Think: 1 liter = 1,000 milliliters, so 5 liters = 5 × 1,000 milliliters, or 5,000 milliliters

2. 3 kilograms = ________ grams

3. 8 liters = ________ milliliters

4. 7 kilograms = ________ grams

5. 9 liters = ________ milliliters

Compare using <, >, or =.

6. 8 kilograms 850 grams

7. 3 liters 3,500 milliliters

Problem Solving

8. Kenny buys four 1-liter bottles of water. How many milliliters of water does Kenny buy?

9. Mrs. Jones bought three 2-kilogram packages of flour. How many grams of flour did she buy?

10. Colleen bought 8 kilograms of apples and 2.5 kilograms of pears. How many more grams of apples than pears did she buy?

11. Dave uses 500 milliliters of juice for a punch recipe. He mixes it with 2 liters of ginger ale. How many milliliters of punch does he make?

12. Write a problem that involves changing kilograms to grams. Explain how to find the solution.
Lesson Check (4.MD.A.1, 4.MD.A.2)

1. During his hike, Milt drank 1 liter of water and 1 liter of sports drink. How many milliliters of liquid did he drink?

2. Larinda cooked a 4-kilogram roast. The roast left over after the meal weighed 3 kilograms. How many grams of roast were eaten during that meal?

Spiral Review (4.MD.A.1, 4.MD.C.6, 4.G.A.1)

3. Use a protractor to find the angle measure.

4. Draw a pair of parallel lines.

5. Carly bought 3 pounds of birdseed. How many ounces of birdseed did she buy?

6. A door is 8 decimeters wide. How wide is the door in centimeters?