Constructing Task: Water Balloon Fun!

STANDARDS FOR MATHEMATICAL CONTENT

MCC4.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)

MCC4.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.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Before students are given this task, they will need to be familiar with customary and metric units of measure. Encourage students to refer to the graphic they created during the "More Punch, Please!" task (see previous tasks in this unit).

Also, in "Capacity Line-Up" students should have had experiences that demonstrated the relationship between milliliters and liters (e.g. how the relationship between a millimeter and a meter are like the relationship between milliliters and liters – it takes 1,000 millimeters to make a meter and it takes 1,000 milliliters to make a liter; how a graduated cylinder that holds 100 mL would need to be filled 10 times in order to fill a 1 liter bottle).

ESSENTIAL QUESTIONS

- How do we compare metric measures of milliliters and liters?
- How do we compare customary measures of fluid ounces, cups, pints, quarts, and gallons?

MATERIALS

- "Water Balloon Fun!" student recording sheet
- *Pastry School in Paris: An Adventure in Capacity* by Cindy Neuschwander or similar book about liquid measure
- Graduated cylinders and measuring cups to simulate balloons.

GROUPING

Individual/Partner Task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

In this task students compare liquid measures using milliliters, liters, fluid ounces, cups, pints, quarts, and gallons.

Comments

This task can be introduced by reading *Pastry School in Paris: An Adventure in Capacity* by Cindy Neuschwander or similar book about liquid measure. While reading the story, discuss the concepts and relationships that are used during the story.

As students are working, observe the strategies they use to solve the given problems. Consider strategies that would be helpful for other members of the class to see and understand. While students are working, ask selected students if they would be willing to share their work with the class. During the lesson summary, have students share the strategies they used with their classmates.

Students may need to use graduated cylinders, measuring cups, and water, rice, or sand to complete this task.

Task Directions

Students will follow the directions below from the "Water Balloon Fun!" student recording sheet.

> Use what you know about the relationship between metric measures of capacity (milliliters, liters) or customary measures (fluid ounces, cups, pints, quarts, gallons) of capacity to solve the following problems. Show all of your work and explain your thinking.
>
> 1. The package for Matt's water balloons says that each balloon holds 300 mL of water. How many balloons can he fill if he has 2 liters of water?
> 2. Beverly has 1.5 liters of water to fill six water balloons. Each balloon holds 0.35 liter of water. Does she have enough water to fill all six balloons? If not, how many balloons can she fill?

3. Camille has 6 water balloons. Each is filled with 4 fluid ounces of water. Bibi has 5 balloons. Each is filled with 1 cup of water. Whose balloons contain the most water?
4. Charlie filled all of his balloons with 2 quarts of water. Warren filled each of his 6 balloons with 1– cups of water. Whose balloons contain the most water?

The answers to the questions presented in this task are given below.

1. **The package for Matt's water balloons says that each balloon holds 300 mL of water. How many balloons can he fill if he has 2 liters of water?**

Students could make a table to help them solve this problem.

Number of Balloons	Amount of Water (in mL)
1	300
2	600
3	900
4	1,200
5	1,500
6	1,800
7	2,100

1,000 mL = 1 L

Using the relationship above and the chart to the left, we know that Matt could fill 6 balloons with 2 liters of water (with 200 mL left over). In order to fill 7 balloons, he would need 2,100 mL or 2 liters 100 mL. So, he would need an additional 100 mL to fill 7 balloons.

So, Matt can fill 6 balloons with 2 liters of water.

2. **Beverly has 1.5 liters of water to fill six water balloons. Each balloon holds 0.35 liter of water. Does she have enough water to fill all six balloons? If not, how many balloons can she fill?**

Students could use a picture to solve this problem. To fill six balloons, Beverly would need 0.35 × 6 liters of water.

0.35 liters 0.35 liters 0.35 liters 0.35 liters 0.35 liters 0.35 liters

She would need a total of 0.35 liter × 6 = 2.1 liters of water. She only has 1.5 liters of water. She only has enough to fill 1.5 liters ÷ 0.35 liters or approximately 4.29 balloons.

So, Beverly can only fill 4 balloons with 1.5 liters of water.

3. **Camille has 6 water balloons. Each is filled with 4 fluid ounces of water. Bibi has 5 balloons. Each is filled with 1 cup of water. Whose balloons contain the most water?**

Students would need to use the following relationships to solve this problem.
8 fluid ounces = 1 cup

Camille has 4 fluid ounces × 6 water balloons = 24 fluid ounces. Knowing that 8 ounces equals 1 cup, we know that Camille has 24 fluid ounces ÷ 8 fluid ounces = 3 cups of water.

Bibi has 1 cup × 5 balloons = 5 cups of water. 5 cups is more than 3 cups. So, Bibi's balloons contain 2 cups more water.

4. **Charlie filled all of his balloons with 2 quarts of water. Warren filled each of his 6 balloons with 1– cups of water. Whose balloons contain the most water?**

Students could make a table to help them solve this problem.

Warren's Balloons	
Number of Balloons	Amount of Water (in Cups)
1	1–
2	3
3	4–
4	6
5	7–
6	9

2 cups = 1 pint
2 pints = 1 quart
So, 4 cups = 1 quart

Using the relationship above and the chart to the left, we know that Warren would need 9 cups of water to fill 6 balloons. If 4 cups = 1 quart, then 8 cups = 2 quarts. Therefore Warren used 2 quarts + 1 cup of water. That is 1 cup more than the amount of water Charlie used. So, Warren's balloons contain more water.

FORMATIVE ASSESSMENT QUESTIONS

- How can you compare those amounts of water?
- What are the relationships you need to know in order to solve this problem? How do you know?
- How will you use those relationships to solve this problem?
- How much water will he (or she) need? How do you know?
- Who has more water in their balloons? How do you know?
- How can you model this problem?
- Why did you choose to model the problem this way?

DIFFERENTIATION

Extension

- Encourage students to create story problems that require the comparison of liquid measures and to solve the problems. Ask a partner to solve the problems.

Intervention

- Some students may need opportunities to solve the problems using measuring cups and water, rice, or sand.
- Provide students with a table that displays the relationships between different units of measure. This will allow students to focus on what the problem is asking.
- Similarly, some students may benefit by using a calculator to solve these problems. That would allow them to concentrate on the problem, not the operations required using decimal numbers.

Name____________________________________ Date _______________

Water Balloon Fun!

Use what you know about the relationship between metric measures of capacity (milliliters, liters) or customary measures (fluid ounces, cups, pints, quarts, gallons) of capacity to solve the following problems. Show all of your work and explain your thinking.

1. The package for Matt's water balloons says that each balloon holds 300 mL of water. How many balloons can he fill if he has 2 liters of water?	
2. Beverly has 1.5 liters of water to fill six water balloons. Each balloon holds 0.35 liter of water. Does she have enough water to fill all six balloons? If not, how many balloons can she fill?	
3. Camille has 6 water balloons. Each is filled with 4 fluid ounces of water. Bibi has 5 balloons. Each is filled with 1 cup of water. Whose balloons contain the most water?	
4. Charlie filled all of his balloons with 2 quarts of water. Warren filled each of his 6 balloons with 1– cups of water. Whose balloons contain the most water?	