Constructing Task: More Punch, Please!

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 units of measure. Customary units of capacity and their relationship to each other (e.g. ounce, cup, pint, quart, and gallon).

According to Van de Walle (2006) "*volume* typically refers to the amount of space that an object takes up" whereas "*capacity* is generally used to refer to the amount that container will hold" (p. 265). To distinguish further between the two terms, consider how the two are measured. Volume is measured using linear measures (ft, cm, in, m, etc) while capacity is measured using liquid measures (L, mL, qt, pt, g, etc). However, Van de Walle reminds educators, "having made these distinctions [between volume and capacity], they are not ones to worry about. The term *volume* can also be used to refer to the capacity of a container" (p. 266).

Van de Walle, J. A. & Lovin, L. H. (2006). *Teaching students-centered mathematics: Grades 3-5*. Boston: Pearson Education, Inc.

ESSENTIAL QUESTIONS

- How are fluid ounces, cups, pints, quarts, and gallons related?
- How can fluid ounces, cups, pints, quarts, and gallons be used to measure capacity?
- Why do we need to be able to convert between capacity units of measurement?

MATERIALS

"More Punch, Please!" student recording sheet

GROUPING

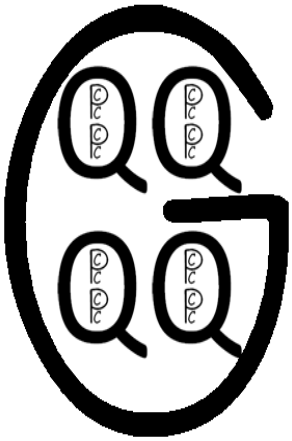
Individual/Partner Task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

In this task students work with liquid measures to determine the amount of punch needed for a class party.

Comments

Before this task is introduced (or as an opening to this task), students could be asked to create a graphic representing the relationship between customary measurements of capacity. Using rice, small beans, sand, or water, they can find the relationships between the different units of measure (ounce, cups, pints, quarts, and gallons). Once students know how the different units of measure are related, they can create a graphic representation of these relationships. Allow students to create a graphic representation that makes sense to them. Then allow students to share their graphic representations with students in their small group or choose two or three students who created different representations to share their graphic representation with the class. One possible representation is shown to the right.



In the graphic representation shown, each "C" represents a cup, each "P" represents a pint, each "Q" represents a quart, and the "G" represents a gallon. This model shows there are 16 cups in a gallon, 8 pints in a gallon, and 4 quarts in a gallon. Students can then be asked to convert between different customary measurements using their model as a reference. For example, ask students questions such as:

- If I have 2 quarts of punch, how many cups do I have?
- How many quarts would 12 cups fill?
- How many pints would be needed to fill 3 quarts?
- How many cups are in 6 pints?
- If one cup is 8 fluid ounces, how many fluid ounces are in a pint? Quart? Gallon?

The quantities used in the recipe in this task can be adjusted for the number of students in fourth grade at your school. Also, the context of the task can be adapted to better suit a particular school's traditions (e.g. fourth grade dance rather than a fourth grade party).

Task Directions

Students will follow the directions below from the "More Punch, Please!" student recording sheet.

> We are making punch for a fourth grade party. A little more than 100 students will attend the party. The recipe below will serve 16 students.
>
> **Party Punch**
> Serves 16 (serving size: 8 fluid ounces)
> **Ingredients:**
> 2 Pints Strawberry Sherbet
> 2 Quarts Fruit Punch, chilled
> 32 Fluid Ounces Lemon-Lime flavored carbonated beverage, chilled
> **Directions:**
> Place sherbet in punch bowl. Pour in fruit punch and lemon-lime soda.
>
> Answer the following questions about the punch for the party. Show all work and explain how you know your answers are accurate.
> 1. How much of each ingredient needs to be purchased to serve punch at the party? Rewrite the recipe to serve over 100 students.
> 2. How many total gallons of punch can be made with the ingredients purchased?
> 3. If each serving is 12 fluid ounces, how many servings can be made with the ingredients purchased?

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

1. **How much of each ingredient needs to be purchased to serve punch at the party? Rewrite the recipe to serve over 100 students.**

   $16 \times 7 = 112$ therefore, multiplying the recipe by 7 will allow for more than 100 students.

   The following ingredients will be needed:

   <u>Strawberry Sherbet</u>

   2 pints of Strawberry Sherbet $\times$ 7 = 14 pints of Strawberry Sherbet
   There are 8 pints in one gallon, 14 pints $\div$ 8 pints per gallon = 1 gallon and 6 pints.
   There are 2 pints in one quart, 6 pints $\div$ 2 pints per quart = 3 quarts.
   Therefore, 1 gallon and 3 quarts of Strawberry Sherbet will be needed.

Fruit Punch

2 quarts of Fruit Punch × 7 = 14 quarts of Fruit Punch
There are 4 quarts in one gallon, 14 quarts ÷ 4 quarts per gallon = 3 gallons and 2 quarts.
So, 3 gallons and 2 quarts of Fruit Punch will be needed.

Lemon-Lime Soda

32 fluid ounces of Lemon-Lime Soda × 7 = 224 fluid ounces
There are 8 fluid ounces in one cup, 224 fluid ounces ÷ 8 fluid ounces per cup = 28 cups.
There are 16 cups in one gallon, 28 cups ÷ 16 cups per gallon = 1 gallon and 12 cups.
There are 4 cups in one quart, 12 cups ÷ 4 cups per quart = 3 quarts.
Therefore, 1 gallon and 3 quarts of Lemon-Lime Soda will be needed.

2. **How many total gallons of punch can be made with the ingredients purchased?**

   Add 1 gallon and 3 quarts, 3 gallons and 2 quarts, and 1 gallons and 3 quarts. There is a total of 5 gallons and 8 quarts. But there are 4 quarts in a gallon, so 8 quarts ÷ 4 quarts per gallon = 2 gallons. Adding the 2 gallons + 5 gallons, means there will be a total of 7 gallons of punch.

3. **If each serving is 12 fluid ounces, how many servings can be made with the ingredients purchased?**

   There is a total of 128 fluid ounces in one gallon (8 fluid ounces per cup × 16 cups per gallon = 128 fluid ounces per gallon). 7 gallons × 128 fluid ounces per gallon = 896 fluid ounces total.
   Divide the total number of fluid ounces by the number of fluid ounces per serving, 896 ÷ 12 = 74 twelve fluid-ounce servings and 8 fluid ounces left over.

FORMATIVE ASSESSMENT QUESTIONS

- How many batches of the recipe will you need? How do you know?
- How much sherbet will you need to buy? How many pints do you need? How many pints in a gallon? How many gallons is that? How do you know?
- How many quarts of Fruit Punch do you need? How many quarts in a gallon? How many gallons of Fruit Punch do you need? How do you know?
- How much Lemon-Lime soda do you need? How many fluid ounces in a gallon? How many gallons of Lemon-lime soda do you need? How do you know?
- How many fluid ounces in a gallon? How many fluid ounces of punch will you make? How many 8 fluid ounce servings is that? How do you know?

DIFFERENTIATION

Extension

- Encourage students to find a different punch recipe and to rewrite the recipe to serve over 100 students.
- Ask students to determine what size drink is typical (they can consider the type of cup being used, whether ice will be available, and other factors that may influence the amount of punch served to each student). Once students have collected data, they can display the data, choosing the most effective data display.

Intervention

- Some students may need opportunities to develop an understanding of how different measures are related by filling cup, pint, quart, and gallon containers with rice, sand, or water to determine the relationships between these liquid measures.
- Some students may benefit from using a chart to help them organize their thinking and their work. See sample below, "More Punch, Please!, Version 2" student recording sheet.

Name_____ Date _____

More Punch, Please!

We are making punch for a fourth grade party. A little more than 100 students will attend the party. The recipe below will serve 16 students.

Party Punch
Serves 16 (serving size: 8 fluid ounces)

Ingredients:
2 Pints Strawberry Sherbet
2 Quarts Fruit Punch, chilled
32 Fluid Ounces Lemon-Lime flavored carbonated beverage, chilled

Directions:
Place sherbet in punch bowl. Pour in fruit punch and lemon-lime soda.

Answer the following questions about the punch for the party. Show all work and explain how you know your answers are accurate.

1. How much of each ingredient needs to be purchased to serve punch at the party? Rewrite the recipe to serve over 100 students.
2. How many total gallons of punch can be made with the ingredients purchased?
3. If each serving is 12 fluid ounces, how many servings can be made with the ingredients purchased?

Name_____ Date _____

More Punch, Please!

Version 2

We are making punch for a fourth grade party. A little more than 100 students will attend the party. The recipe below will serve 16 students.

Party Punch
Serves 16 (serving size: 8 fluid ounces)

Directions:
Place sherbet in punch bowl. Pour in fruit punch and lemon-lime soda.

Ingredients:
2 Pints Strawberry Sherbet
2 Quarts Fruit Punch, chilled
32 Fluid Ounces Lemon-Lime flavored carbonated beverage, chilled

Answer the following questions about the punch for the party. Show all of your work and explain how you know your answers are accurate.

1. **How much of each ingredient needs to be purchased to serve punch at the party? Rewrite the recipe to serve over 100 students.**

Party Punch	
Serves 16 (serving size: 8 fluid ounces)	Serves _____ (serving size: 8 fluid ounces)
2 Pints Sherbet 2 Quarts Punch 32 Fluid Ounces Lemon-Lime	_____ Pints Sherbet _____ Quarts Punch _____ Fluid Ounces Lemon-Lime

2. How many total gallons of punch can be made with the ingredients purchased?

Party Punch	
1 gallon = 4 quarts 1 gallon = 8 pints 1 gallon = 16 cups 1 gallon = 128 fluid ounces 1 quart = 2 pints 1 pint = 2 cups 1 cup = 8 fluid ounces	

3. If each serving is 12 fluid ounces, how many servings can be made with the ingredients purchased?

Party Punch	
_____ Total Gallons of Punch	1 gallon = 128 fl. oz.
_____ Total fluid ounces of Punch	
_____ Total 12 ounce servings	