

# Capacity Counts

Brief Overview:

**In this unit, students will explore capacity units using estimation, exact measurements and conversions. Students will move from estimating appropriate units to converting from cups, pints, quarts and gallons. They will also have the opportunity to use problem solving as part of the assessment.**

NCTM Content Standard/National Science Education Standard:

- **Students will understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.**
- **Students will carry out simple unit conversions, such as from centimeters to meters, within a system of measurement.**
- **Students will select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature and the size of angles.**

Grade/Level:

**Grades 3-4**

Duration/Length:

**(4 days) 60 minutes for days 1-3 and 30 minutes on day 4 for the assessment**

Student Outcomes:

**Students will:**

- **Estimate units of capacity in everyday containers**
- **Identify exact equivalent units of capacity**
- **Convert units of capacity and find equivalent units of capacity**

Materials and Resources:

**Lesson 1**

- **Cup, pint, quart and gallon containers**
- **Various real-life examples of each unit of capacity**
- **Teacher Resource 1**
- **Student Resource 1**
- **Access to water (sink)**

- Funnel
- Paper towels for clean-up (optional)

### Lesson 2

- Tape
- 16 counters for each student
- Student Resources 2, 3, and 4

### Lesson 3

- Teacher Resource 2
- Student Resources 5, 6, 7, and 8
- Copy Student Resources 5, 6, and 7 on heavy cardstock paper, if possible.

### Lesson 4 – (Summative Assessment)

- Teacher Resources 3 and 4
- Student Resources 9 and 10

Development/Procedures:

### Lesson 1

#### Pre-Assessment

- Display a cup, pint, quart, and gallon container. Have a student come to the front and order the jars from least to greatest.
- Ask students: *“How do you know this is the correct order? How can you find out exactly?”*
- Ask students where they have seen objects this size.

#### Launch

- Read the story Tiddalick: The Frog Who Caused a Flood by Robert Roennefeldt.
- Discuss how students could measure all the water that Tiddalick drank.
- Ask students: *“How else could people measure amounts of water?”*

#### Teacher Facilitation

- Students will work with a partner to estimate the number of cups in each container. Record estimates. Next, have them fill each container with water using the funnel. Students will record on their data table (Student Resource 1) how many cups it took to fill each container.

Circulate around the room to check on student progress of the activity. Be sure students are making one tally for each cup poured. Review how to make tally marks as necessary. Answer key can be found on Teacher Resource 1.

- Discuss which container would be the best to measure how much Tiddalick drank during the story. (*gallon*) *Why is this best unit of measure? What else could you use? Elicit student responses to these questions.*

### **Student Application**

- Match the capacity containers with real-life examples and discuss why those items come in those size capacity containers. (*The juice box is about a cup because you don't need a whole lot for one meal.*) Have students provide several other examples.

### **Embedded Assessment**

- Revisit the data table students completed with the water activity. Discuss with students that the amount of liquid in each container has its own name. Write the names on the lines provided on the chart below each container number. (*cup, pint, quart, gallon*)
- Assign students the questions at the bottom of Student Resource 1 to use as an exit ticket from the lesson.

### **Reteaching/Extension**

- Assign students to go home and find a capacity container to bring in to show the class. Possible containers may include soda bottles, milk jugs, and soup cans.

## **Lesson 2**

### **Pre-Assessment**

- Present objects from home and have students estimate the amounts with the capacity containers they worked with the day before. Have students discuss what unit their container represents. (*Soup can is about 1 cup.*)

### **Launch**

- Give each student a copy of Student Resource 2. Precut this resource into four pieces and give each student only one section. Discuss how many cups are in a pint, quart and gallon and the relationship between each. For example, 2 cups = 1 pint. Model how the graphic organizer makes it easier to remember how many cups are in each unit of capacity. Call on students to use the graphic organizer to restate how many cups are in a pint, quart and in a gallon.

### Teacher Facilitation

- Give each student a copy of Student Resources 3 and 4. Have students cut out the cube and tape it together.
- Give 16 counters to each student.
- Explain that students will practice showing equivalent units of capacity by playing the “Build-A-Gallon Game”. In this game, students roll the cube and use counters to mark their game board with the appropriate amount (cup, pint, or quart). The student who gets 16 cups (1 gallon) wins the game. The exact amount of liquid measure must be used to fill the container. For example, if a student needs 3 cups to win and they roll a quart, they may not take their turn. One quart would have one cup more than is needed. The game would return to the other player. Direct students to use their graphic organizer to find equivalent units as needed.
- Circulate around the room as students are playing to assess students who are having difficulty finding equivalent units. Redirect them to use the graphic organizer.
- Allow students to play the game as long as time permits.

### Student Application

- Discuss with students why it is important to know equivalent units. Possible answers may include knowing that you may not always have the right measuring tool. You may need to mix and match to get the total needed. *How can we use units of liquid measure in our everyday lives?*

### Embedded Assessment

- Assess students’ understanding as you circulate around the room while they are playing “Build-A-Gallon”. Review the graphic organizer again. *Ask: How many cups are in a pint? How many pints are in a quart? How many quarts are in a gallon? Etc.*

### Reteaching/Extension

- Assign students to play the Build-A-Gallon game with their family at home.
- Encourage students who are ready for more of a challenge to play the game without using the graphic organizer.
- Students may recreate the number cube to include new choices for the game.

### Lesson 3

#### Pre-Assessment

- Assign students to complete the following problems in their math journal or on a piece of notebook paper. Allow students to use the graphic organizer (Student Resource 2) from Lesson 2. 3 pints = \_\_\_\_\_ cups, 3 gallons = \_\_\_\_\_ pints, and 12 quarts = \_\_\_\_\_ gallons. Have students explain the strategy they used to solve each problem. (*Use a number sentence, draw a picture, etc.*)

#### Launch

- Review the warm-up from the pre-assessment. Allow several minutes for students to share their strategies with the class.

#### Teacher Facilitation

- Distribute Student Resources 5 and 6.
- Discuss with students how to play dominos. Explain the idea is to match like amounts by connecting the ends of the dominos.
- Allow students to cut out dominos. Direct students to only cut on the dotted lines. Have students work in pairs. Place all the dominos pieces face down. Each person should pick a domino until all dominos have been chosen. The student who is the youngest goes first by placing a domino on the table. The next student goes by finding a matching equivalent unit of capacity that matches one of the sides. For example, 1 gallon can match 16 cups or 4 quarts or 8 pints. If they do not have a matching domino, they lose a turn. Play continues until one of the players is out of dominos first.

#### Student Application

- Discuss how the domino game helped build knowledge of equivalent units of capacity. Ask if there was a strategy to playing the game. Ask if they needed the graphic organizer to help with conversions.
- Distribute Student Resource Sheet 8. Complete Problem 1 as an example and show students multiple strategies to solve the problem. Give students about several minutes to try to solve each word

**problem. Make sure students show their work and label answers correctly. See Teacher Resource 2 for answers.**

### **Embedded Assessment**

- **Circulate during the domino activity. Take note of students who are still struggling with finding equivalent units and reinforce using the graphic organizer.**
- **Review word problem sheet with students stressing problem-solving techniques. Allow time for students to orally share how they may have solved the problems differently.**
- **Assign students a journal entry with the following question to close the lesson. *“Describe a situation when you had to use units of capacity in your life.”***

### **Reteaching/Extension**

- **Allow students who still need support to use the graphic organizer for the domino game and word problem sheet.**
- **Extension- Assign students to create new dominos (Student Resource 7) or word problems to add to the ones they already answered.**

## **Lesson 4**

### **Summative Assessment:**

**Students will demonstrate their understanding of units of capacity and finding equivalent units of capacity by completing a Brief Constructed Response (BCR) and various Selected Response questions. Use Student Resources 9 and 10 to assess student mastery of these concepts. These assessments will require students to use mathematical thinking, apply mathematics and justify their thinking.**

### **Appendix A: Student Resources**

- **Estimation Data Table, Student Resource 1**
- **What’s in a Gallon, Student Resource 2**
- **Build-A-Gallon Cube, Student Resource 3**
- **Build-A-Gallon Game Board, Student Resource 4**
- **Conversion Dominos Set 1, Student Resource 5**
- **Conversion Dominos Set 2, Student Resource 6**
- **Conversion Dominos Blank Set, Student Resource 7**
- **Word Problems, Student Resource 8**

- **Brief Constructed Response, Student Resource 9**
- **Selected Response, Student Resource 10**

#### **Appendix B: Teacher Resources**

- **Estimation Data Table Key, Teacher Resource 1**
- **Word Problem Key, Teacher Resource 2**
- **Brief Constructed Response Key, Teacher Resource 3**
- **Selected Response Key, Teacher Resource 4**

#### **Authors:**

**Jessica Schiery  
Perrywood Elementary School  
Prince George's County, MD**

**Kristen Robel  
Worcester Preparatory School  
Worcester County, MD**

**Directions:** Estimate how many cups will fill each container. Write your estimation in the first column. Use tally marks to measure the number of cups in each container. Write tally marks in second column. Total the tally marks in the last column.

	Estimation	Tally Marks	Total
Container #1 _____			
Container #2 _____			
Container #3 _____			
Container #4 _____			

1. Were your estimations close to the actual total? Explain. \_\_\_\_\_

\_\_\_\_\_

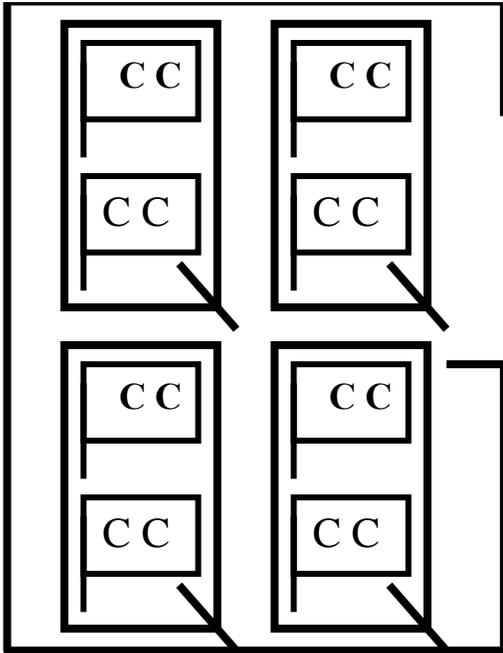
2. Which container had the most number of cups? \_\_\_\_\_

3. Which container had the least number of cups? \_\_\_\_\_

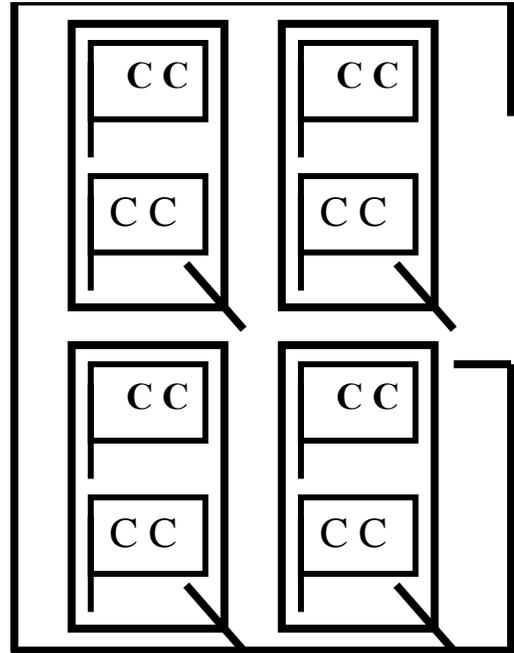
4. What is the difference in the number of cups of Container #4 and Container #1?  
Show your work.

--

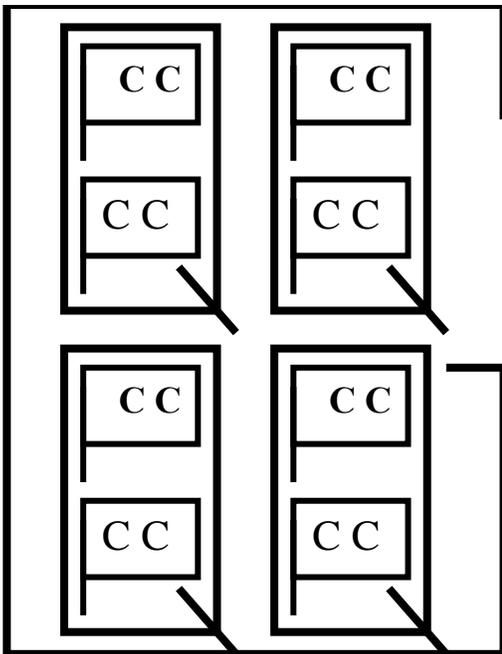
What's in a Gallon?  
(Quarts, Pints, and Cups!)



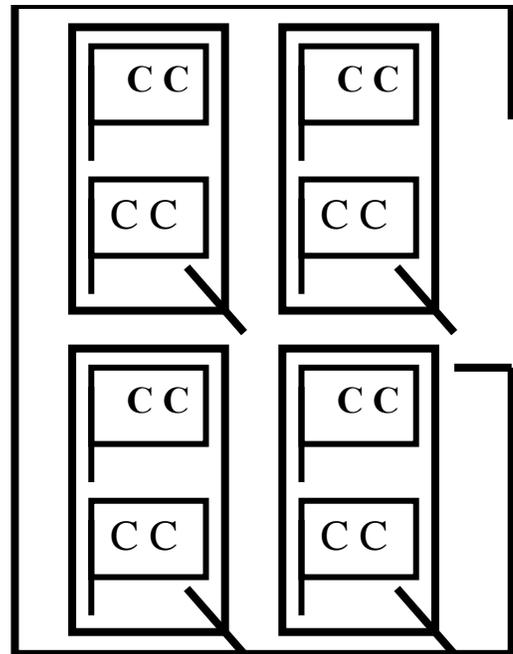
What's in a Gallon?  
(Quarts, Pints, and Cups!)

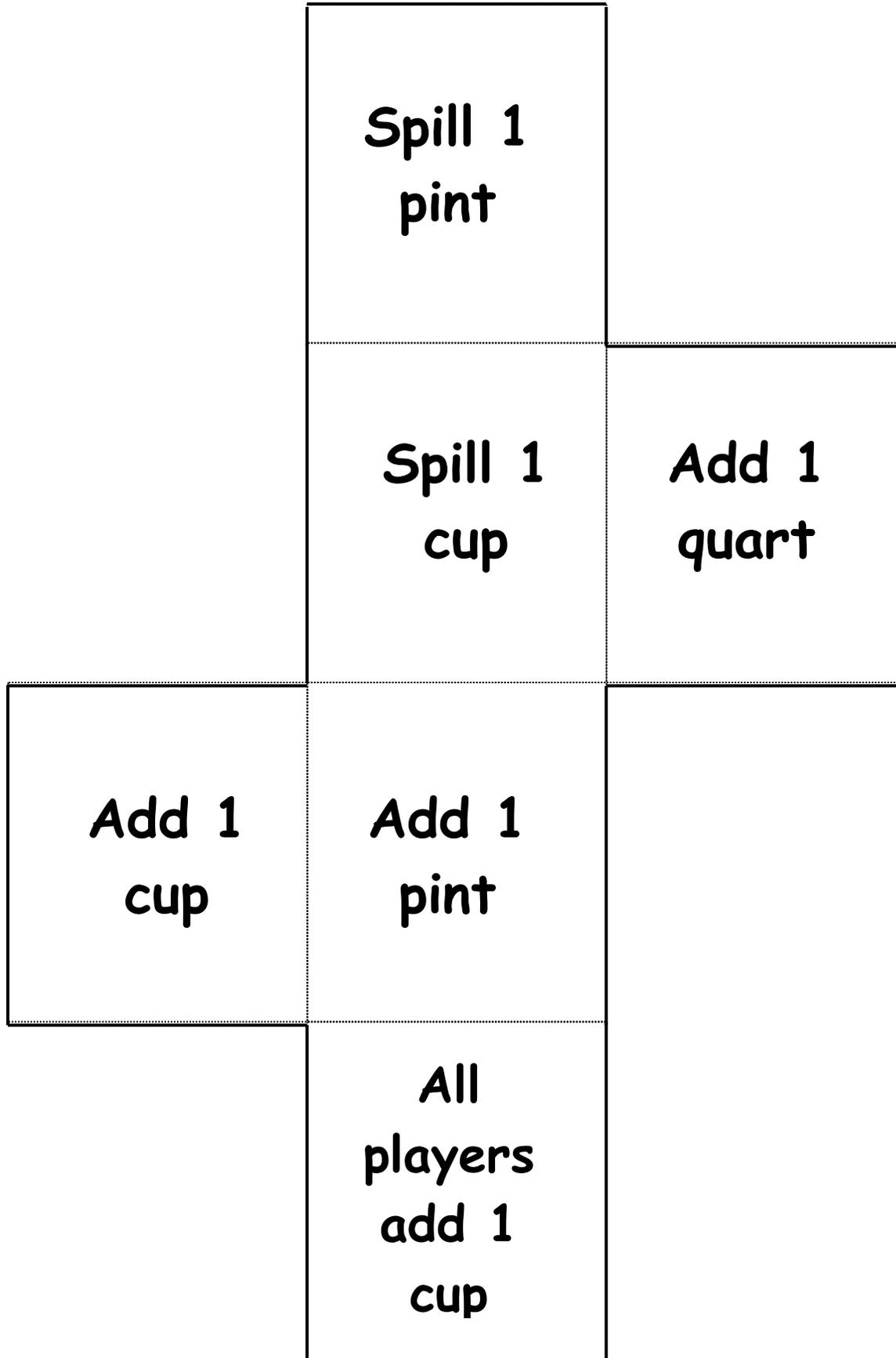


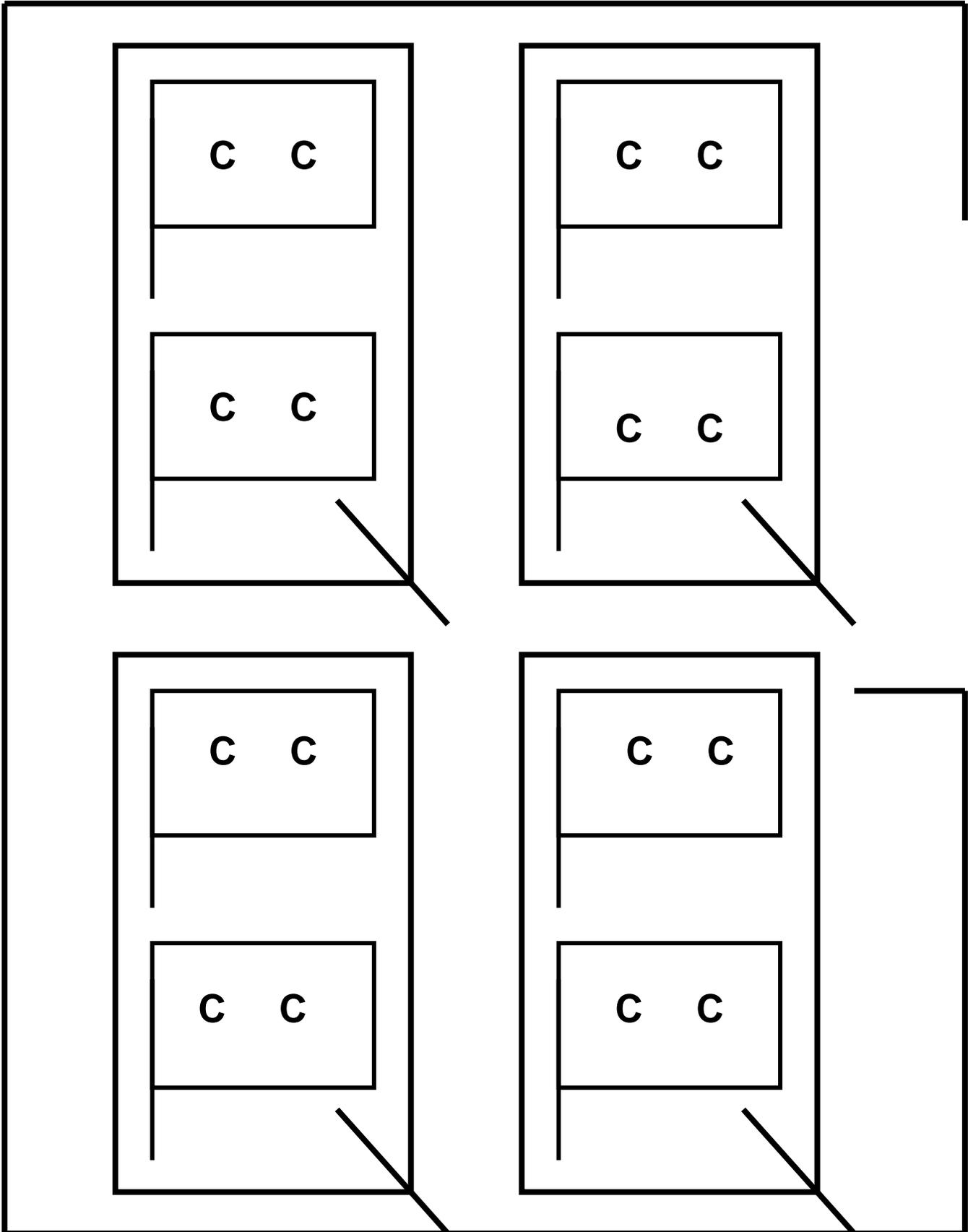
What's in a Gallon?  
(Quarts, Pints, and Cups!)



What's in a Gallon?  
(Quarts, Pints, and Cups!)







<b>1 cup</b>	<b>1 gallon</b>	<b>2 cups</b>	<b>2 cups</b>
<b>2 cups</b>	<b>4 quarts</b>	<b>4 cups</b>	<b>4 cups</b>
<b>4 cups</b>	<b>8 pints</b>	<b>8 cups</b>	<b>8 cups</b>
<b>16 cups</b>	<b>1 pint</b>	<b>16 cups</b>	<b>16 cups</b>
<b>2 pints</b>	<b>4 pints</b>	<b>1 pint</b>	<b>1 pint</b>
<b>1 cup</b>	<b>1 cup</b>	<b>2 pints</b>	<b>2 pints</b>

<b>4 pints</b>	<b>4 pints</b>	<b>2 cups</b>	<b>1 quart</b>
<b>8 pints</b>	<b>8 pints</b>	<b>4 cups</b>	<b>4 pints</b>
<b>1 quart</b>	<b>1 quart</b>	<b>1 gallon</b>	<b>8 cups</b>
<b>4 quarts</b>	<b>4 quarts</b>	<b>16 cups</b>	<b>1 cup</b>
<b>1 gallon</b>	<b>1 gallon</b>	<b>2 pints</b>	<b>2 quarts</b>
<b>1 cup</b>	<b>1 pint</b>	<b>8 cups</b>	<b>1 gallon</b>



<p><b>1. Monica went on a picnic with 3 friends. She brought 1 gallon of lemonade. If Monica and her friends drink 2 quarts, how many quarts of lemonade are left?</b></p>	<p><b>2. Harvey needs 4 pints of lemon tea, 2 pints of ice water, and 2 pints of raspberry tea to make his favorite punch. How many gallons of punch will Harvey make?</b></p>
<p><b>3. The students in Mrs. Teague's third grade class each drank 1 cup of water after recess. If there are 16 students in her class, how many total quarts did the students drink?</b></p>	<p><b>4. There are six houseplants in Mr. Zim's house. He likes to water each plant with one cup of water every Saturday. How many pints of water does Mr. Zim use to water his plants on Saturday?</b></p>
<p><b>5. There were 6 quarts of soda for the party. Two quarts got knocked over and spilled on the floor. How many quarts of soda are left?</b></p>	<p><b>6. Robert drinks 1 cup of milk everyday with breakfast. How many pints of milk does Robert drink in 8 days?</b></p>
<p><b>7. Bonnie took a shower and used 32 gallons of water. Betsy took a bath and used 55 gallons of water. How many more gallons did Betsy use than Bonnie?</b></p>	<p><b>8. The level of water at the community swimming pool was low. There were 83,972 gallons of water. The pool supervisor must add 3,250 gallons of water. How many gallons of water will the community pool now have?</b></p>

**Brief Constructed Response**

**Megan has to make punch for her party. The recipe calls for 2 gallons of juice, but she only has a one-cup container.**

**Step A**

**How many cups will she need to make her punch so it will equal 2 gallons?**

\_\_\_\_\_

**Step B**

**Use what you know about equivalent units of capacity to explain why your answer is correct. Use words and/or numbers in your explanation.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Selected Responses**

1. 4 pints = \_\_\_\_\_ cups.

- a. 4
- b. 8
- c. 2
- d. 10

2. 3 gallons = \_\_\_\_\_ quarts.

- a. 12
- b. 3
- c. 16
- d. 4

3. 16 cups = \_\_\_\_\_ quarts.

- a. 8
- b. 16
- c. 4
- d. 12

4. What would you use to measure the capacity of a swimming pool?

- a. cup
- b. pint
- c. quart
- d. gallon

**Directions:** Estimate how many cups will fill each container. Write your estimation in the first column. Use tally marks to measure the number of cups in each container. Write tally marks in second column. Total the tally marks in the last column.

	Estimation	Tally Marks	Total
Container #1 cup			1
Container #2 pint			2
Container #3 quart			4
Container #4 gallon		<del>    </del> <del>    </del> <del>    </del>	16

1. Were your estimations close to the actual total? Explain. **Student responses may vary, but should include a clear explanation.**
2. Which container had the most number of cups? **Container #4**
3. Which container had the least number of cups? **Container #1**
4. What is the difference in the number of cups of Container #4 and Container #1? Show your work.

**Container 4 – Container 1 = Difference**

**16 cups – 1 cup = 15 cups**

<p>1. Monica went on a picnic with 3 friends. She brought 1 gallon of lemonade. If Monica and her friends drink 2 quarts, how many quarts of lemonade are left?</p> <p><b>1 gallon = 4 quarts</b> <b>4 quarts – 2 quarts = 2 quarts</b></p> <p><b>Answer: 2 quarts</b></p>	<p>2. Harvey needs 4 pints of lemon tea, 2 pints of ice water, and 2 pints of raspberry tea to make his favorite punch. How many gallons of punch will Harvey make?</p> <p><b>4 pints + 2 pints + 2 pints = 8 pints</b> <b>8 pints = 1 gallon</b></p> <p><b>Answer: 1 gallon</b></p>
<p>3. The students in Mrs. Teague’s third grade class each drank 1 cup of water after recess. If there are 16 students in her class, how many total quarts did the students drink?</p> <p><b>1 cup x 16 students = 16 cups</b> <b>4 cups = 1 quart, 8 cups = 2 quarts,</b> <b>12 cups = 3 quarts, 16 cups = 4 quarts</b></p> <p><b>Answer: 4 quarts</b></p>	<p>4. There are six houseplants in Mr. Zim’s house. He likes to water each plant with one cup of water every Saturday. How many pints of water does Mr. Zim use to water his plants on Saturday?</p> <p><b>6 plants x 1 cup = 6 cups of water</b> <b>2 cups = 1 pint, 4 cups = 2 pints,</b> <b>6 cups = 3 pints</b></p> <p><b>Answer: 3 pints</b></p>
<p>5. There were 6 quarts of soda for the party. Two quarts got knocked over and spilled on the floor. How many quarts of soda are left?</p> <p><b>6 quarts – 2 quarts = 4 quarts</b></p> <p><b>Answer: 4 quarts</b></p>	<p>6. Robert drinks 2 cups of milk everyday with breakfast. How many cups of milk does Robert drink in 8 days?</p> <p><b>2 cups x 8 days = 16 cups</b></p> <p><b>Answer: 16 cups</b></p>
<p>7. Bonnie took a shower and used 32 gallons of water. Betsy took a bath and used 55 gallons of water. How many more gallons did Betsy use than Bonnie?</p> <p><b>55 gallons – 32 gallons = 23 gallons</b></p> <p><b>Answer: 23 gallons</b></p>	<p>8. The level of water at the community swimming pool was low. There were 83,972 gallons of water. The pool supervisor must add 3,250 gallons of water. How many gallons of water will the community pool now have?</p> <p><b>83,975 gallons + 3,250 gallons =</b></p> <p><b>Answer: 87,225 gallons</b></p>

Name \_\_\_\_\_

**Brief Constructed Response**

Megan has to make punch for her party. The recipe calls for 2 gallons of juice, but she only has a one-cup container.

**Step A**

How many cups will she need to make her punch so it will equal 2 gallons?

**32 cups**

---

**Step B**

Use what you know about equivalent units of capacity to explain why your answer is correct. Use words and/or numbers in your explanation.

**Possible Answer: I know there are 16 cups in 1 gallon. The**

---

**problem said there were 2 gallons.  $16 + 16 = 32$  cups.  $16 \times 2 = 32$**

---

**cups.**

---

**Students could also draw a picture similar to their graphic**

---

**organizer they have been using or any other appropriate**

---

**strategy.**

---

Name \_\_\_\_\_

**Selected Responses**

1. 4 pints = \_\_\_\_\_ cups.

- e. 4
- f. 8**
- g. 2
- h. 10

2. 3 gallons = \_\_\_\_\_ quarts.

- e. 12**
- f. 3
- g. 16
- h. 4

3. 16 cups = \_\_\_\_\_ quarts.

- e. 8
- f. 16
- g. 4**
- h. 12

4. What would you use to measure the capacity of a swimming pool?

- e. cups
- f. pints
- g. quarts
- h. gallons**