Learning Experience:

Discovering Capacity – Guided Math

AKS: 34.MD.1 – compare one unit to another within a single system of capacity measurement and record measurement equivalents in a two-column table, including l, ml, c, pt, qt, gal.

Vertical Alignment:

Third Grade: 27.MD.2 estimate and measure liquid volumes and masses of objects to include the metric units grams, kilograms, liters and the customary units ounces, cups, pints, quarts, and gallons. Excludes compound units such as cm3 and finding the geometric volume of a container.

Fifth Grade: 28.MD.1 convert among different-sized measurement units within a given measurement system and use these conversions in solving multi-step, real world problems (e.g., convert 5 cm to 0.05 m, 3 ft to 36 in, 120 minutes to 2 hours)

Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Model with mathematics.
8. Look for and express regularity in repeated reasoning.

Materials: pocket chart
Sentence strips
Containers (cup, pint, quart, gallon, liter, milliliter)
12 unmeasured/unmarked containers of various sizes
Capacity by Henry Pluckrose
Hershey's Weights and Measures by Jerry Pallotta
See pages at the end of this document for additional materials needed
Optional materials: ThinkMath lessons 9.6, 9.7, 9.8, 15.4, 15.5

Vocabulary:

cup
pint
quart
gallon
liter
milliliter
capacity
fluid ounces
half gallon
estimate (estimating)

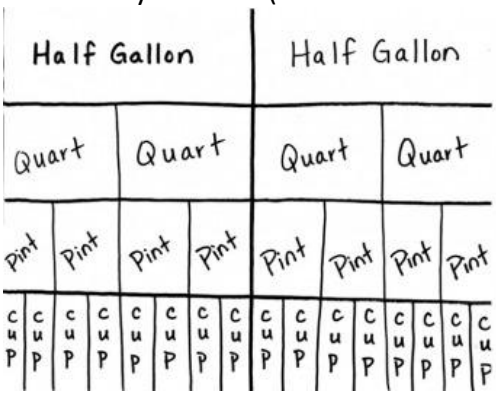
Essential Questions:
How are fluid ounces, cups, pints, quarts, and gallons related?
How can fluid ounces, cups, pints, quarts, and gallons be used to measure capacity?
How can we estimate and measure capacity?
How do we compare customary measures of fluid ounces, cups, pints, quarts, and gallons?
How do we compare metric measures of milliliters and liters?

Activating Strategy: Create a "Twitter" board. Laminate a sentence strip for each student labeled with their name &/or photo. Using a pocket chart, put this question at the top: How can I measure liquid? Students write their responses on their sentence strip, then add their strip to the pocket chart, newest response at the top (stack strips that are "out of view" below chart or in a specified location. (Use this activity for other topics/questions throughout the year.)

Instructional Activity:
Day 1: Guided Group- Ask students what they know about gallons, quarts, pints and cups. Each student or group gets measuring tools and a container of water. Discuss the correct name for each container. Allow students to explore the relationships using the containers and water, and then record the information in their math notebooks.
Questions:

- How many quarts of water did it take to fill the gallon container?
- How many pints did it take to fill the quart?
- How many pints would it take to fill the gallon container?

Have students demonstrate the answers to the questions.
Groups: Interactive Technology (All metric measurement terms: http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks2/maths/measures/index.htm), Vocabulary Practice (students create chart: label page as gallon) -



Independent Practice - Tools for Measurement blackline masters (3 pages)
Day 2: Guided Group- Display and briefly discuss the Frayer model (at the end of this document). Allow students to complete the Frayer model independently in their math notebook. Read the first word problem and solve it using the measuring containers and water or punch. Use the questions from day 1 for the word problem.
Groups: Interactive Technology (Metric capacity practice: http://www.bbc.co.uk/skillswise/game/ma23capa-game-taking-measures-capacity), Vocabulary Practice – buddy reading of books & record 3 facts or ideas from the book, Practice – Capacity Concentration game

Day 3: Guided Group- Have students repeat Day 1 activity with metric units and Frayer model. Groups: Interactive Technology (Metric conversion practice: http://www.iboard.co.uk/iwb/115), Practice 1 – M – Capacity in Customary Units pdf file, Practice 2 – M – Capacity in Metric Units pdf file **Day 4:** Guided Group- Read & discuss the "Got Milk" exemplar. Work through step by step, using a chart to show work. Groups: Interactive Technology (Metric conversion concentration: http://sheppardsoftware.com/mathgames/measurement/MeasurementLiters.htm), Practice – followme_capacity game, Independent Practice – Day 4 Independent Practice pages 1. Expanding the experience Connect fractions knowledge to the Customary Conversion Chart. Connect to recipes. 2. Extending the experience Answer the essential questions in their math notebooks. Rework activity (when possible) using other measurement units.
Summarizing: Students create two word problems using metric and customary units. Problems should include solutions and appropriate use of vocabulary.

Frayer Model

What it is	What it is not
Capacity	
Units	How would you use it

Name _____ Date _____

Challenge

Matching Capacity

Cut out the game cards below. Mix the cards and place them face down. Choose two cards and turn them over. Decide if the two cards show the same capacity. If they do, set the pair to the side. If the values do not match, turn the cards face down again. The game continues until all cards are matched. If there are two or more players, the winner is the player with the most matching pairs.

1 gallon	4 quarts	1 pint	2 cups
1 quart	2 pints	3 pints	6 cups
5 quarts	10 pints	2 quarts	8 cups
2 gallons	16 pints	3 gallons	48 cups
6 pints	3 quarts	5 pints	10 cups
1 quart	4 cups	1 gallon	8 pints

Name _____ Date _____

Challenge

Matching Capacity

Cut out the game cards below. Mix the cards and place them face down. Choose two cards and turn them over. Decide if the two cards show the same capacity. If they do, set the pair to the side. If the values do not match, turn the cards face down again. The game continues until all cards are matched. If there are two or more players, the winner is the player with the most matching pairs. **Check students' matches.**

1 gallon	4 quarts	1 pint	2 cups
1 quart	2 pints	3 pints	6 cups
5 quarts	10 pints	2 quarts	8 cups
2 gallons	16 pints	3 gallons	48 cups
6 pints	3 quarts	5 pints	10 cups
1 quart	4 cups	1 gallon	8 pints

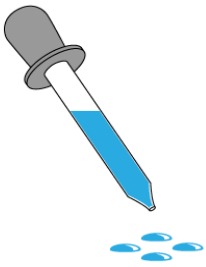
Name: _____

Milliliters and Liters

A **liter** (L) and a **milliliter** (mL) are two units for measuring capacity in the metric system.

This bottle holds 1 liter of water.

To convert liters to milliliters, multiply by 1,000.



A milliliter is about 4 drops of water.

To convert milliliters to liters, divide by 1,000.

1. 3,000 mL = _____ L

2. 8 L = _____ mL

3. 60 L = _____ mL

4. 80,000 mL = _____ L

5. 41,000 mL = _____ L

6. 70 L = _____ mL

7. 100 L = _____ mL

8. 5,000 mL = _____ L

9. 93,000 mL = _____ L

10. 52 L = _____ mL

11. 200,000 mL = _____ L

12. 600 L = _____ mL

13. A recipe calls for 2 L of water and 1 L of milk. How many mL is this combined?

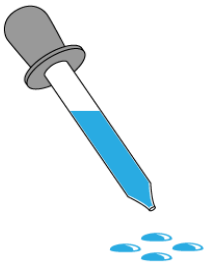
ANSWER KEY

Milliliters and Liters

A **liter** (L) and a **milliliter** (mL) are two units for measuring capacity in the metric system.

This bottle holds 1 liter of water.

To convert liters to milliliters, multiply by 1,000.



A milliliter is about 4 drops of water.

To convert milliliters to liters, divide by 1,000.

1. 3,000 mL = **3** L

2. 8 L = **8,000** mL

3. 60 L = **60,000** mL

4. 80,000 mL = **80** L

5. 41,000 mL = **41** L

6. 70 L = **70,000** mL

7. 100 L = **100,000** mL

8. 5,000 mL = **5** L

9. 93,000 mL = **93** L

10. 52 L = **52,000** mL

11. 200,000 mL = **200** L

12. 600 L = **600,000** mL

13. A recipe calls for 2 L of water and 1 L of milk. How many mL is this combined?

3,000 mL

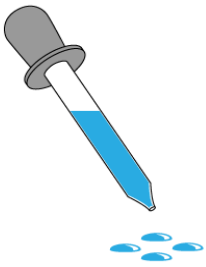
Name: _____

Milliliters and Liters

A **liter** (L) and a **milliliter** (mL) are both units for measuring capacity, or volume, in the metric system.

This bottle holds 1 liter of water.

To convert liters to milliliters, multiply by 1,000.



A milliliter is about 4 drops of water.

To convert milliliters to liters, divide by 1,000.

1. 6,000 mL = _____ L

2. 7 L = _____ mL

3. 3.12 L = _____ mL

4. 500 mL = _____ L

5. 760 mL = _____ L

6. 2.42 L = _____ mL

7. 8.1 L = _____ mL

8. 5,210 mL = _____ L

9. 41,000 mL = _____ L

10. 0.4 L = _____ mL

11. 90,000 mL = _____ L

12. 720 L = _____ mL

13. You have 1 L of milk. You drink 250 mL. How much milk do you have left?

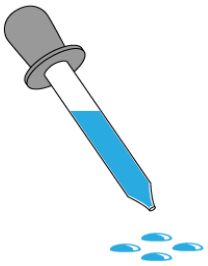
ANSWER KEY

Milliliters and Liters

A **liter** (L) and a **milliliter** (mL) are both units for measuring capacity, or volume, in the metric system.

This bottle holds 1 liter of water.

To convert liters to milliliters, multiply by 1,000.



A milliliter is about 4 drops of water.

To convert milliliters to liters, divide by 1,000.

1. 6,000 mL = **6** L

2. 7 L = **7,000** mL

3. 3.12 L = **3,120** mL

4. 500 mL = **0.5** L

5. 760 mL = **0.76** L

6. 2.42 L = **2,420** mL

7. 8.1 L = **8,100** mL

8. 5,210 mL = **5.21** L

9. 41,000 mL = **41** L

10. 0.4 L = **400** mL

11. 90,000 mL = **90** L

12. 720 L = **720,000** mL

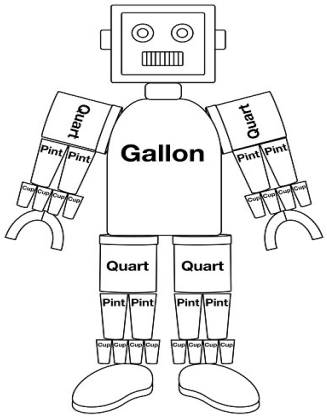
13. You have 1 L of milk. You drink 250 mL. How much milk do you have left? **750 mL**

Name: _____ Level 3

Measuring Capacity

1 gallon = 4 quarts = 8 pints = 16 cups

1 gallon = 4 quarts
1 quart = 2 pints
1 pint = 2 cups



Fill in the correct number for each statement.

a. 3 gallons = _____ pints

b. 6 gallons = _____ quarts

c. ½ gallon = _____ pints

d. ½ quart = _____ cups

e. 1½ pints = _____ cups

f. 2½ gallons = _____ cups

Circle the greater amount for each pair.

g. 12 quarts or 6 gallons

g. 10 quarts or 5 gallons

h. 6 cups or 2½ pints

i. 4½ cups or 2 quarts

j. 16 pints or 8½ quarts

k. ½ gallon or 3½ quarts

Find the best answer and explain.

l. Each day, Isaac feeds his puppy one cup of dog food in the morning and one cup in the evening. How many quarts of food does Isaac feed his puppy during a week? Explain how you found your answer.

answer: _____

explain: _____

_____

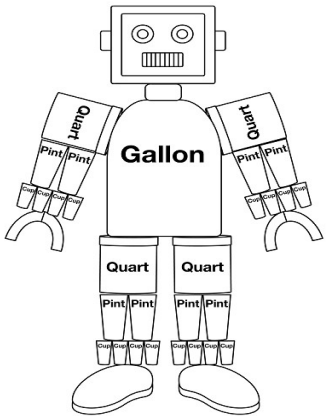
_____

ANSWER KEY

Measuring Capacity

1 gallon = 4 quarts = 8 pints = 16 cups

1 gallon = 4 quarts
1 quart = 2 pints
1 pint = 2 cups



Fill in the correct number for each statement.

a. 3 gallons = **24** pints

b. 6 gallons = **24** quarts

c. ½ gallon = **4** pints

d. ½ quart = **2** cups

e. 1½ pints = **3** cups

f. 2½ gallons = **40** cups

Circle the greater amount for each pair.

g. 12 quarts or 6 gallons

g. 10 quarts or 5 gallons

h. 6 cups or 2½ pints

i. 4½ cups or 2 quarts

j. 16 pints or 8½ quarts

k. ½ gallon or 3½ quarts

Find the best answer and explain.

l. Each day, Isaac feeds his puppy one cup of dog food in the morning and one cup in the evening. How many quarts of food does Isaac feed his puppy during a week? Explain how you found your answer.

answer: **3½ quarts**

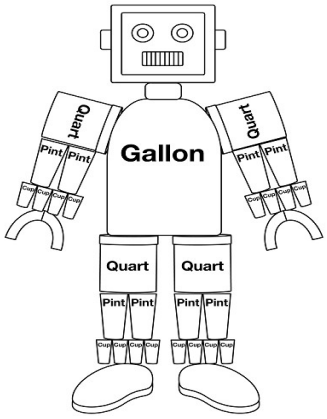
explain: **He feeds his puppy 7 pints per day. 7 pints is equal to 3½ quarts.**

Name: _____ Level 1

Measuring Capacity

1 gallon = 4 quarts = 8 pints = 16 cups

1 gallon = 4 quarts
1 quart = 2 pints
1 pint = 2 cups



Fill in the correct number for each statement.

a. 1 gallon = _____ pints

b. 1 gallon = _____ quarts

c. 1 quart = _____ pints

d. 1 quart = _____ cups

e. 1 pint = _____ cups

f. 1 gallon = _____ cups

Circle the greater amount for each pair.

g. 2 quarts or 1 gallon

g. 5 quarts or 1 gallon

h. 4 cups or 1 pint

i. 2 cups or 1 quart

j. 4 pints or 1 quart

k. 2 pints or 2 quarts

Circle the best answer for each question.

l. Sara-Beth puts milk on her cereal. How much milk does she probably use?

1 gallon 1 quart 1 pint

m. Tom wants to paint his bedroom walls a different color. How much paint is he most likely to buy?

2 gallons 1 quart 3 cups

n. Each day, Isaac feeds his puppy one cup of dog food in the morning and one cup in the evening. How much food does Isaac feed his puppy during a weekend?

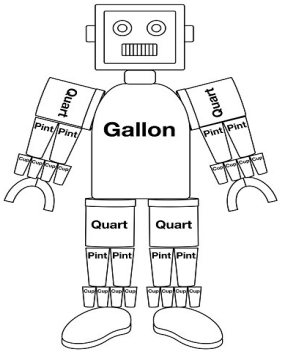
1 gallon 1 quart 1 pint

ANSWER KEY

Measuring Capacity

1 gallon = 4 quarts = 8 pints = 16 cups

1 gallon = 4 quarts
1 quart = 2 pints
1 pint = 2 cups



Fill in the correct number for each statement.

a. 1 gallon = **8** pints

b. 1 gallon = **4** quarts

c. 1 quart = **2** pints

d. 1 quart = **4** cups

e. 1 pint = **2** cups

f. 1 gallon = **16** cups

Circle the greater amount for each pair.

g. 2 quarts or (1 gallon)

g. (5 quarts) or 1 gallon

h. (4 cups) or 1 pint

i. 2 cups or (1 quart)

j. (4 pints) or 1 quart

k. 2 pints or (2 quarts)

Circle the best answer for each question.

l. Sara-Beth puts milk on her cereal. How much milk does she probably use?

1 gallon 1 quart (1 pint)

m. Tom wants to paint his bedroom walls a different color. How much paint is he most likely to buy?

(2 gallons) 1 quart 3 cups

n. Each day, Isaac feeds his puppy one cup of dog food in the morning and one cup in the evening. How much food does Isaac feed his puppy during a weekend?

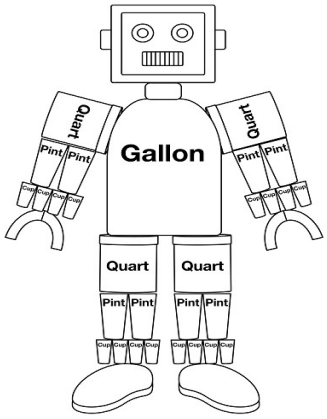
1 gallon (1 quart) 1 pint

Name: _____ Level 2

Measuring Capacity

1 gallon = 4 quarts = 8 pints = 16 cups

1 gallon = 4 quarts
1 quart = 2 pints
1 pint = 2 cups



Fill in the correct number for each statement.

a. 2 gallons = _____ pints

b. 4 gallons = _____ quarts

c. 3 quarts = _____ pints

d. 6 quarts = _____ cups

e. 5 pints = _____ cups

f. 3 gallons = _____ cups

Circle the greater amount for each pair.

g. 4 quarts or 2 gallons

g. 20 quarts or 4 gallons

h. 12 cups or 3 pints

i. 4 cups or 2 quarts

j. 16 pints or 4 quarts

k. 12 pints or 12 quarts

Circle the best answer and explain.

l. Each day, Isaac feeds his puppy one cup of dog food in the morning and one cup in the evening. How much food does Isaac feed his puppy during a week?

less than 1 gallon exactly 1 gallon more than one gallon

_____

_____

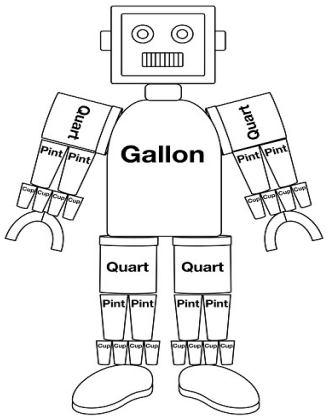
_____

ANSWER KEY

Measuring Capacity

1 gallon = 4 quarts = 8 pints = 16 cups

1 gallon = 4 quarts
1 quart = 2 pints
1 pint = 2 cups



Fill in the correct number for each statement.

a. 2 gallons = **16** pints

b. 4 gallons = **16** quarts

c. 3 quarts = **6** pints

d. 6 quarts = **24** cups

e. 5 pints = **10** cups

f. 3 gallons = **48** cups

Circle the greater amount for each pair.

g. 4 quarts or 2 gallons

g. 20 quarts or 4 gallons

h. 12 cups or 3 pints

i. 4 cups or 2 quarts

j. 16 pints or 4 quarts

k. 12 pints or 12 quarts

Circle the best answer and explain.

l. Each day, Isaac feeds his puppy one cup of dog food in the morning and one cup in the evening. How much food does Isaac feed his puppy during a week?

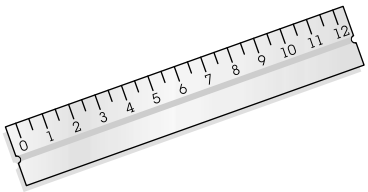
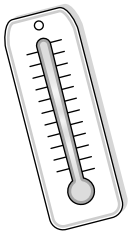
less than 1 gallon exactly 1 gallon more than one gallon

Isaac feeds his puppy a pint of food each day. Seven pints is less than one gallon.

Name _____ Date _____

TOOLS FOR MEASUREMENT

Different tools are used to measure different things. For example:

Length	Volume
Rulers 	Measuring cups 
Temperature	**Weight**
Thermometers 	Scales 

Choose the best tool to measure each item. Write *ruler, measuring cup, thermometer,* or *scale*.

1. the temperature outside

_____

2. the length of a ribbon

_____

3. the weight of a bag of apples

_____

4. the amount of milk in a container

_____

Which tool was used to make each measurement? Write *ruler, measuring cup, thermometer,* or *scale*.

5. The paper is 8 inches long.

_____

6. The cook uses 1 cup of juice.

_____

7. The water freezes at 32°F.

_____

8. The cat weighs 10 pounds.

_____

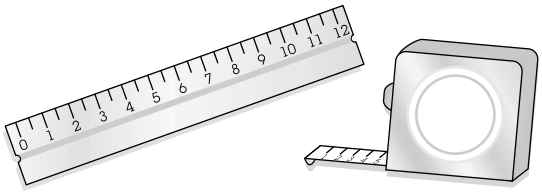
Name _____ Date _____

TOOLS FOR MEASUREMENT

Different tools are used to measure different things. For example:

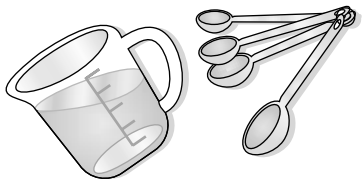
Length

Rulers, tape measures



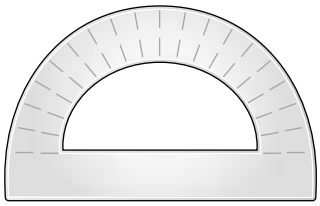
Volume

Measuring cups, measuring spoons



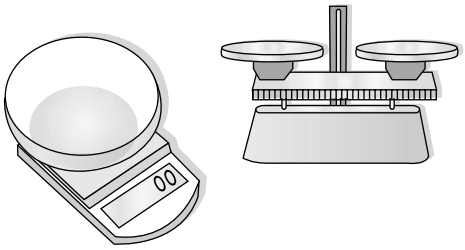
Angle Measure

Protractors



Weight or Mass

Scales, balances



Choose the best tool to measure each item. Write ruler, tape measure, measuring cup, measuring spoon, protractor, or scale.

1. the width of a door

_____

2. the angle of a corner

_____

Which tool was used to make each measurement? Write *ruler, measuring cup, protractor,* or *scale.*

3. The cook uses $\frac{1}{2}$ cup of milk.

_____

4. The book weighs 10 ounces.

_____

5. The angle has a measure of 60°.

_____

6. The model is 6 inches long.

_____

Name _____ Date _____

TOOLS FOR MEASUREMENT

The appropriate tool should be used to make a measurement. For example:

Length: rulers, yardsticks, tape measures, meter sticks
Use rulers for shorter lengths and yardsticks or tape measures for longer lengths.
Units of length include inches, feet, yards, centimeters, and meters.

Volume: measuring spoons, measuring cups, gallon containers
Units of volume include cups, gallons, and liters.

Angle Measure: protractors
An angle opening is measured in degrees.

Weight or Mass: scales, balances
Units of weight include ounces or pounds.
Units of mass include grams or kilograms.

Choose the best tool to measure each item. Write *ruler, yardstick, tape measure, meter stick, gallon container, measuring cup, measuring spoon, protractor, scale, or* balance.

1. an angle of 30° _____

2. the length of a caterpillar _____

What does each measurement measure? Write *length, volume, angle measure, mass*, or *weight*. Then write the tool used to make each measurement. Write *ruler, measuring cup, protractor, scale,* or balance.

3. Rita bought 3 pounds of apples.
_____
_____

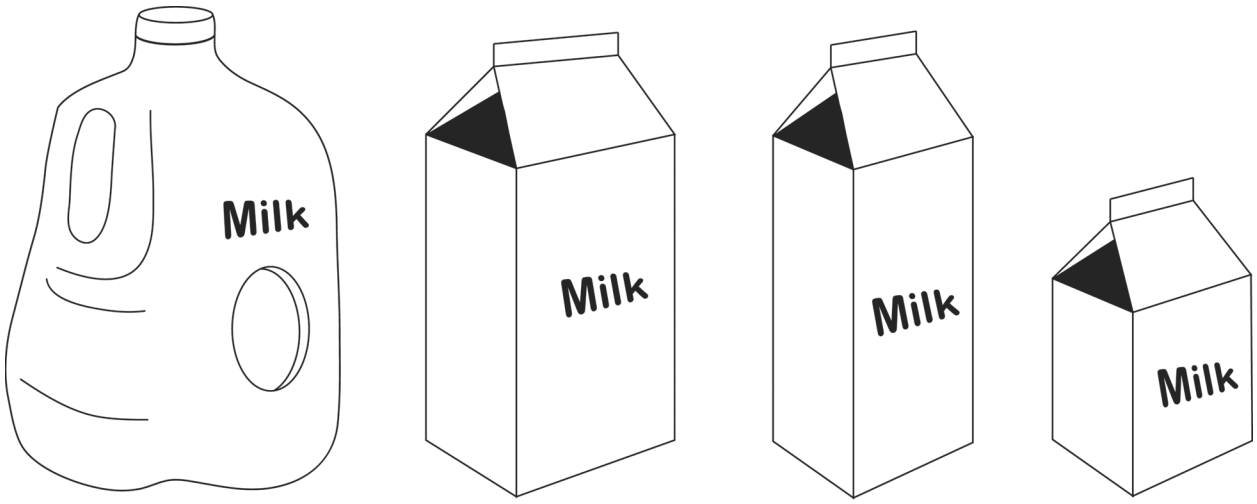
4. The pitcher holds 1 liter of water.
_____
_____

START What is 0.5 litres in ml	500ml What is 1000 ml in litres?	1 litre What is 3 litres in ml?
3000 ml What is 1 ½ litres in ml?	1500 ml What is 5000 ml as litres?	5 litres What is ¾ of a litre in ml?
750 ml What is 8 tenths of a litre in ml?	800 ml What is 250 ml as litres?	0.25 l What is 4500 ml as litres?
4 ½ litres What is 2750 ml as litres?	2 ¾ litres (or 2.75 litres) What is 0.9 l in ml?	900 ml What is 500 ml + 500ml + 100ml the same as?
1.1 litres What is 7 litres in ml?	7000 ml What is 5 ½ litres in ml?	5500ml What is 9100 ml in litres?
9.1 litres What is 200ml + ½ litre?	700ml What is 3 litres + 200 ml?	3.2 litres What is 3 tenths of a litre the same as?
300 ml What is 8 ½ litres in ml?	8500ml What is 600 ml + 600 ml?	1.2 litres What is 4 litres + 8 tenths of a litre the same as?

4.8 litres (4 litres 800 ml) What is 1 litre – 1000ml?	0 What is 200ml + 6 litres?	6.2 litres What is 2000 ml the same as?
2 litres What is 10 litres in ml?	10,000 ml What is 2 and ¼ litres in ml?	2250ml FINISH

Got Milk?

You have been asked to supply milk for the medieval feast in our class. When you go to the store to buy some, you discover you have many choices. You can buy milk in pints, quarts, 1/2 gallons and gallons. You know you have to buy 16 servings, and ideally each person should get a 6-ounce serving. You also realize you should not waste money or food, so you only want to buy as much as we need. What should you buy and why? Remember to show all your work.



$2.39 Gallon | $1.59 Half Gallon | $1.19 Quart | $0.65 Pint

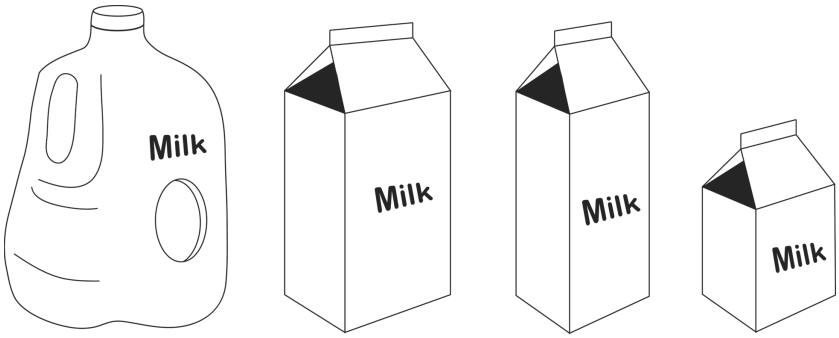
Got Milk?

Suggested Grade Span

3–5

Task

You have been asked to supply milk for the medieval feast in our class. When you go to the store to buy some, you discover you have many choices. You can buy milk in pints, quarts, 1/2 gallons and gallons. You know you have to buy 16 servings, and ideally each person should get a 6-ounce serving. You also realize you should not waste money or food, so you only want to buy as much as we need. What should you buy and why? Remember to show all your work.



$2.39 Gallon $1.59 Half Gallon $1.19 Quart $0.65 Pint

Alternative Versions of Task

More Accessible Version

You have been asked to supply milk for the medieval feast in our class. When you go to the store to buy some, you discover you have many choices. You can buy milk in pints, quarts, 1/2 gallons and gallons. You know you have to buy 16 servings, and ideally each person should get a 6-ounce serving. How many cups of milk will you need in all?

Note: 1 cup = 8 ounces

More Challenging Version

The original version, and …

Determine the cost per cup of milk in each of these different-sized containers.

Context

Measurement had been a unit that this fourth-grade class had been working on prior to this problem. Students had worked with capacity and liquid measurement in a variety of settings. Students were also exposed to an earlier unit on money. The teacher wanted to see what students could recall in terms of money from a previous unit and what could they apply in terms of liquid measurements in this problem. Since the class was also preparing for a medieval feast, the problem fit nicely into a real-life application.

What This Task Accomplishes

This task allows students to determine the most effective way to spend money and still have enough milk for the feast. Students were assessed on two mathematical fronts: What do they know about liquid measurement? What can they do in terms of applying and comparing monetary amounts?

Time Required for Task

Allow one class period, about 45–60 minutes, to compete the task.

Interdisciplinary Links

A cooking unit would fit nicely into this type of problem. Linking up with your living-arts teacher to create a problem about cooking that students would actually solve and then do would be ideal.

Teaching Tips

One of the biggest tips that proved successful for these students was to allow them many opportunities to explore with measurements. They measured water, sand and other various liquids as part of their exploratory lessons. We worked with some visual models to show the relationship between gallons, quarts and pints, and given all of that, students were able to be successful with this problem.

Suggested Materials

- Measuring cups
- Calculators

Possible Solutions

The best solution is to buy a half gallon and one quart of milk for a total of $2.78.

More Accessible Version Solution

16 servings x 6 ounces per person = 96 ounces
96 ounces ÷ 8 ounces in a cup = 12 cups

More Challenging Version Solution:

See the solution to the original version, and …

Gallon at $2.39 ÷ 16 cups = .14937 cents per cup
Half gallon at $1.59 ÷ 8 cups = .19875 cents per cup
Quart at $1.19 ÷ 4 cups = .2975 cents per cup
Pint at $0.65 ÷ 2 cups = .325 cents per cup

Task-Specific Assessment Notes

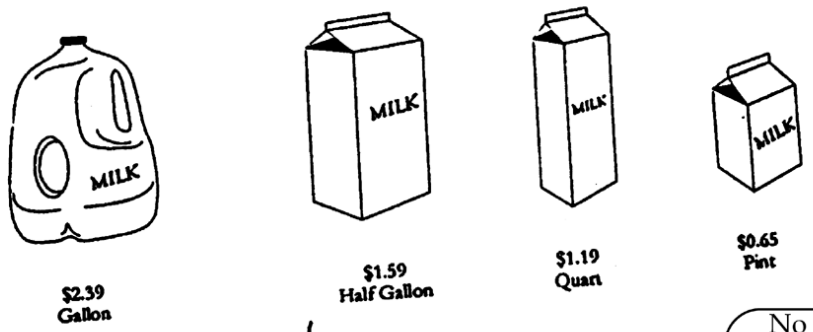
Novice
The work at this level will show no understanding of the task. The student may record amounts but does not show any indication as to how those amounts were determined. An attempt at an explanation will prove to be unsuccessful and will leave the reader with gaps and questions throughout.

Apprentice
The work at this level will show that the student understands part of the problem. The student may neglect to determine the cost for the amount of milk that s/he will buy or will make other errors. The Apprentice's explanation will be brief and to the point, which leaves some questions about the reasoning used. Math language will be extremely limited, and a math representation will be lacking in the work.

Practitioner
The work at this level will show a thorough understanding of the problem. This student's work will show the ability to compute to reach a correct solution. The Practitioner's explanation will be clear and concise, making sense throughout.

Expert
This Expert's work will be exceptional and will utilize a sophisticated strategy and mathematical concepts. The Expert will have a correct solution throughout, and the approach and reasoning will be explained. All work will be shown in a logical presentation. The Expert will also make mathematically relevant observations and connections.

Novice



It is unclear why the student chose this combination.

1 = $3.97

No reasoning is evident.

The student attempts a math representation, but it serves no purpose.

Keys H.G.=Half Gallon

I noticed that I learned how much 8 ounces equal 1cup.
I solved the problem by using all the letters and seeing which price is the cheapest price I found out that 1 carton of Half gallon and 2 quarts carton

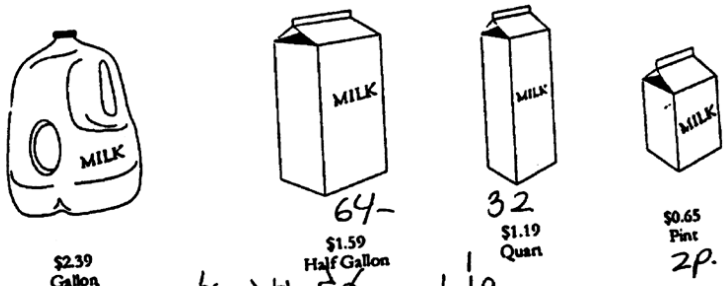
Total $3.97

Gallon	$											
H.G.	1											
Quart	2											
P.												

$1.19
+1.19
$2.38
+1.59
3.97

Some math language is used.

Apprentice

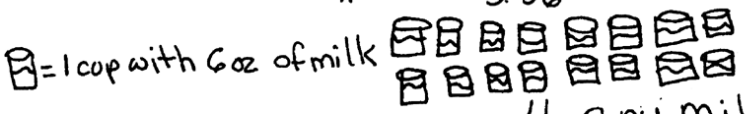


This student's solution is only partially correct. The student had a correct solution for one class, but for two classes it would be cheaper to buy one gallon and one one–half gallon.

96
+96
192

$1.59
$2.39
3.98
5.98
$7.96

1.19
+1.59
2.78
2.78
5.56



I noticed that there isn't any milk left over. 16 x 6 = equals 96 You need 96 oz. of milk for your class. Mrs Lowe's class has 16 kids too so You need 96 oz. for them too Add that and your total is 192 oz of milk needed. I noticed that I can buy milk at $2.78 just for my class. If I was including my class and Mrs. Lowe's class it would be $5.56 for milk.
Answer: My class 1 half gallon & 1 quart
Answer: Mrs. Lowe's and my class 2 half gallons & 2 quarts

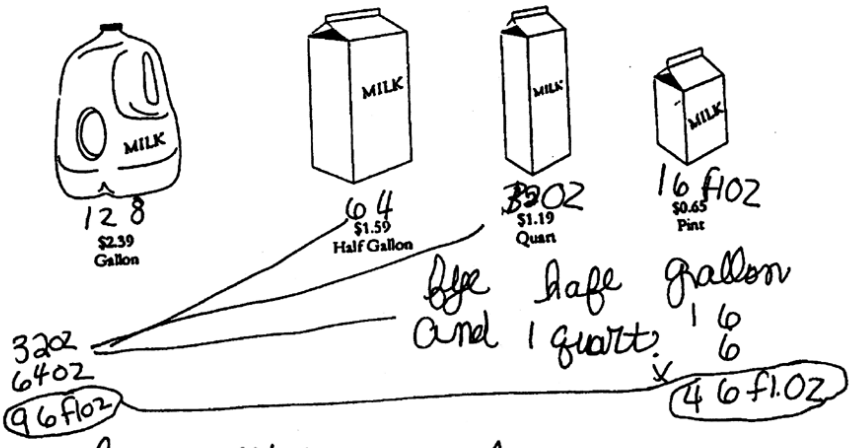
Math language is used throughout.

Some correct reasoning is used. The last statement demonstrates incorrect reasoning, although it would seem logical.

Practitioner

Student shows all work.

A correct answer is achieved.



I multiplyed 16 by 16 and get 96 then add 24 over 32 and get 96 oz fully half gallon and 1 quart.

cost $1.59
+$1.19
$2.78

Cheaper then 3 quart

See
$1.19
$1.19
$1.19
$3.57

Student shows the cheapest combination found. Correct language and labels are used throughout.

Expert

Student shows unit conversion.

Sophisticated math language and notation are used throughout.

8 ounce = 1 cup (8x1)
2 cups = 1 pint = 16 ounces (8x2)
2 pints = 1 quart = 32 ounces (8x4)
2 quarts = 1 half gallon = 64 ounces (8x8)
2 half gallons = 1 gallon 128 ounces (8 x 16)

I noticed each time 8 gets multiplied exponentially ($2^0, 2^1, 2^2, 2^3, 2^4$)

16 Kids x 6 ounces = 96 ounces needed

Need to find cheapest milk.

size	total cost	# oz.	Cost per oz
Gallon	2.39	128	0.0186718
half gallon	1.59	64	0.0248437
Quart	1.19	32	0.0371875
pint	0.65	16	0.040625

The student made a mathematically relevant observation.

Use largest container possible = cheapest

64 (half gallon)
+ 32 (quart)
96 (ounces)

1.59
1.19
$2.78 Total price

The student explains his/her reasoning.

All work is shown.

Got Milk?

BRIDGES IN MATHEMATICS 4

GRADE 4 SUPPLEMENT

Set D2 Measurement: Capacity in U.S. Customary Units

Includes

Skills & Concepts

★ estimate and measure capacity in U.S. customary units

★ carry out simple conversions within a system of measurement, such as cups to quarts

Published by The MATH LEARNING CENTER *Salem, Oregon*

P1210

Bridges in Mathematics Grade 4 Supplement
Set D2 Measurement: Capacity In U.S. Customary Units

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set D2 ★ Activity 1

ACTIVITY

Estimate, Order & Measure Ounces Cups & Quarts

Overview

Students estimate the capacity of 6 different containers, ordering them from least to greatest capacity. Then they determine the actual capacities to check their estimates. This activity is designed for use by student pairs during Work Places or other work periods.

Skills & Concepts

★ estimate and measure capacity in U.S. customary units

★ Carry out simple conversions within a system of measurement, such as cups to quarts

You'll need

★ Estimate, Order & Measure Instructions (page D2.3, run 1 copy)

★ Estimate, Order & Measure Record Sheet (page D2.4, run a class set)

★ 6 plastic containers (see Advance Preparation)

★ quart container (see Advance Preparation)

★ 1-cup liquid measuring cup from the Number Corner

★ pitcher to hold about 2 quarts of water

★ cafeteria tray

★ towel

Advance Preparation Gather 6 plastic containers of varying capacity (e.g., margarine, yogurt, peanut butter, cream cheese containers, kids' cups from restaurants, and so on). If any of these are already marked with their capacity, black it out with a permanent marker. Run a strip of masking tape up the side of one of the quart containers that came with your Number Corner materials. Mark the tape at 1-cup intervals up to 4 cups. Place the containers, quart container, measuring cup, and pitcher of water on a cafeteria tray. Set up the tray, towel, activity instructions, and record sheets in a location somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.

Instructions for Estimate, Order & Measure: Ounces, Cups & Quarts

1. Explain that you've set up some materials to give students practice estimating and measuring capacity in customary units. Review the terms *cup* and *quart* with the class, and remind students that there are 4 cups in a quart. Then take a close look at the measuring cup with them. One side of the cup is marked milliliters. The other is marked in customary units: fractions of a cup and fluid ounces. Hand the cup to a volunteer and ask her to tell the class how many ounce markings there are on the customary side.

Activity 1 Estimate, Order & Measure Ounces, Cups & Quarts (cont.)

> ***Daria*** *The marks are kind of hard to see, but there are 8 of them. They don't show all the numbers, though. Just 2, 4, 6, and 8, with the word "Oz" at the top.*
>
> ***Teacher*** *Right. Oz is an abbreviation for ounces.*

2. Explain that in the customary system of measurement, people weigh things in ounces, but they also measure capacity in *fluid ounces*. There are 8 fluid ounces in a cup. How many fluid ounces are there in 2 cups? (16) What about a quart? (32) If there are 8 ounces in a cup, what part of a cup is 1 ounce? ($\frac{1}{8}$ of a cup) What about 4 ounces? ($\frac{1}{2}$ a cup)

3. Show students a copy of the Estimate, Order & Measure Ounces instructions and record sheet. Review the instructions with the class, and model the procedure of estimating and measuring as needed. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

NAME _____ **DATE** _____

Estimate, Order & Measure Instructions

This activity will need

★ Estimate, Order & Measure Instructions

★ Estimate, Order & Measure Record Sheet

★ 6 plastic containers labeled with letters A–F

★ pitcher

★ 1-cup measuring cup

★ 1-quart container

★ towel

Instructions for Estimate, Order & Measure Ounces, Cups & Quarts

1 Record your name and the date at the top of a record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this Activity.

2 Look at the 6 containers. Put them in the order you think they belong, from smallest to largest. Record your predictions.

3 Go to the sink with your partner and carefully measure 1–2 quarts of water into the pitcher.

4 Estimate the capacity of Container A. Remember that there are 8 fluid ounces in a cup and 4 cups in a quart. It's okay if you use more than one unit. For example, if it looks like the container holds between 2 and 3 cups, you might estimate 2 cups, 4 ounces. Record your estimate.

5 Use the water, the measuring cup, and the quart container to find out how much water Container A actually holds (to the nearest ounce). Record the actual capacity.

7 Continue estimating and finding the capacity for the other 5 containers. Use what you know about the capacity of the first container to help make your estimates.

8 When you've found out how much each container actually holds, put them in order from smallest to largest, and record their actual ranking.

9 Clean up. After you finish the activity, return all the water to the pitcher and empty the pitcher in the sink. Wipe down the table surface and clear any spills on the floor. Mix up the 6 containers so they're out of order and ready for the next pair of students.

NAME _____ **DATE** _____

Estimate, Order & Measure Record Sheet

Put the containers in the order you think they belong, from smallest to largest. Record your predictions. Then do the second part of the sheet. After you find out how much water each container holds, fill in the second row on this chart to show their actual order.

	1st smallest	2nd	3rd	4th	5th	6th largest
Estimate						
Actual Rank						

Container	Your estimate (to the nearest ounce)	Actual Measurement (to the nearest ounce)
A		
B		
C		
D		
E		
F		

Set D2 ★ Activity 2

ACTIVITY

Which Container Is Best?

Overview

Students estimate which beverage containers are most likely to hold certain amounts of water. Then they test their ideas to find the best containers for several different situations. This activity is designed for use by student pairs during Work Places or other work periods.

Skills & Concepts

★ estimate and measure capacity in U.S. customary units

★ carry out simple conversions within a system of measurement, such as cups to quarts

You'll need

★ Which Container Is Best? Record Sheet (pages D2.6 and D2.7, run a class set)

★ an assortment of 8 or more beverage containers (see Advance Preparation)

★ 1-cup liquid measuring cup (see Advanced Preparation)

★ pitcher to hold about 2 quarts of water

★ cafeteria tray

★ towel

Advance Preparation Gather 8 or more beverage containers of varying capacity (e.g., pop can, water bottles of various sizes, small children's cup, drink containers from restaurants including an extra large or "biggie" size, and so on). Label each container with an alphabet letter. Place the containers, measuring cup, and pitcher of water on a cafeteria tray. Set up the tray, towel, and record sheets in a location somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.

Instructions for Which Container Is Best? (Customary Version)

1. Explain that you've set up some materials to give students more practice estimating and measuring capacity in customary units. Show them a copy of the Which Container Is Best? Record Sheet. Review the instructions on the sheet with the class, and model the procedure of estimating and measuring as needed.

2. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

INDEPENDENT WORKSHEET

See Set D2 Independent Worksheet 1 for more practice estimating and measuring capacity in customary units.

NAME _____ **DATE** _____

Which Container Is Best? Record Sheet page 1 of 2

Directions

a Record your name and the date at the top of the record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.

b For each problem below:

- estimate and record which containers would probably hold the amount of water needed. (It's okay if you choose more than one container that might work.)
- test your estimates using the liquid measuring cup.
- decide which beverage container actually works best.
- record your recommendation.

c Clean up. After you finish the activity, return all the water to the pitcher. Wipe down the table surface and clean up any spills on the floor.

Problems

Nicholas needs to bring some water for several different activities this week. Help him select the best container for each activity

1 For a field trip on Tuesday, Nicholas needs to bring about 2 cups of water to drink.

a Estimate: Which of the containers look like they would hold about 2 cups?

b Use the liquid measuring cup to help you find the drink container that would work best for the field trip.

c Container _____ holds about 2 cups.

2 For soccer practice on Thursday, Nicholas needs to bring about 3 cups of water to drink.

a Estimate: Which of the containers look like they would hold about 3 cups? Are there any two containers that look like they would hold 3 cups combined?

b Use the liquid measuring cup to help you find the drink container (or pair of containers) that would work best for soccer practice.

c Container(s) _____ hold(s) about 3 cups.

Which Container Is Best? Record Sheet page 2 of 2

3 For his soccer game on Saturday, Nicholas needs to bring about a quart of water to drink.

a Estimate: Which of the containers look like they would hold about 1 quart? Are there any combinations of 2 or more containers that might hold 1 quart?

b Use the liquid measuring cup to help you find the drink container (or combination of containers) that would work best for the soccer game.

c Container(s) _____ hold(s) about 1 quart.

CHALLENGE

4 On the way home from soccer games, Nicholas always buys a 64-fluid-ounce soda. How many cups of soda is he drinking in a month if there are 4 Saturdays in a month and he has a soccer game every Saturday? How many gallons?

NAME _____ **DATE** _____

Set D2 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

Just Enough Juice

Teresa is helping to plan a party for her 4th grade class. Her mom has agreed to provide the juice Her class has 28 students.

1 Estimate how many gallons of juice Teresa needs to bring if each child drinks about one cup.

2 If each child drinks one cup of juice, exactly how much juice is needed? You may use measuring tools (1 cup and gallon containers) from your classroom to help you, if needed Show your work.

3 If each child drinks one cup of juice, how many gallons of juice does Teresa need to bring? How much juice will be left over? Show your work.

(Contined on back.)

Independent Worksheet 1 Just Enough Juice (cont.)

CHALLENGE

4 If half of the class drinks a full cup of juice, a quarter of the students each have $\frac{1}{2}$ cup of juice, and a quarter of the students don't drink any, will there be enough for everyone if Teresa only brings one gallon? Show your work.

BRIDGES IN MATHEMATICS 4

GRADE 4 SUPPLEMENT

Set D3 Measurement: Capacity in Metric Units

Includes

Skills & Concepts

★ estimate and measure capacity in metric units

★ carry out simple conversions within a system of measurement, such as milliliters to liters

Published by The MATH LEARNING CENTER *Salem, Oregon*

P0409

Bridges in Mathematics Grade 4 Supplement
Set D3 Measurement: Capacity In Metric Units

The Math Learning Center, PO Box 12929, Salem, Oregon 97309. Tel. 1 800 575–8130.

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Set D3 ★ Activity 1

ACTIVITY

Estimate, Order & Measure Milliliters & Liters

Overview

Students estimate the capacity of 6 different containers, ordering them from least to most capacity. Then they determine the actual capacities to check their estimates. This activity is designed for use by student pairs during Work Places or other work periods.

Skills & Concepts

★ estimate and measure capacity in metric units

★ carry out simple conversations within a system of measurement, such as milliliters to liters

You'll need

★ Estimate, Order & Measure Instructions (page D3.3, run 1 copy)

★ Estimate, Order & Measure Record Sheet (page D3.4, run a class set)

★ 6 plastic containers (see Advance Preparation)

★ 1-cup liquid measuring cup (see Advance Preparation)

★ pitcher to hold about 2 liters of water

★ cafeteria tray

★ towel

Advance Preparation Gather 6 plastic containers of varying capacity (e.g., margarine, yogurt, peanut butter, cream cheese containers, kids' cups from restaurants, and so on). If any of these are already marked with their capacity, black it out with a permanent marker. Label each container with an alphabet letter, A–F. Find the 1-cup measure that came with your Number Corner materials. If you haven't done so already, use the Calibration Strip on Number Corner Blackline 7.5 to calibrate the cup in increments of 10 milliliters. Place the containers, measuring cup, and pitcher of water on a cafeteria tray. Set up the tray, towel, activity instructions, and record sheets in a location somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.

Instructions for Estimate, Order & Measure: Milliliters & Liters

1. Explain that you've set up some materials to give students practice estimating and measuring capacity in metric units. Review the terms *capacity*, *milliliter*, and *liter* with the class.

Activity 1 Estimate, Order & Measure (cont.)

Note *If you've done the March Calendar Collector with your class, students will already be familiar with milliliters. If not, pass the measuring cup to a volunteer and ask her to find the mark on the cup that shows 200 milliliters. How does this mark compare with the mark on the other side that shows 1 cup? If students are unfamiliar with metric units of capacity, it may help them to see that 200 milliliters is a little less than 1 cup, while the 250 milliliter mark near the very top of the measuring cup is just a little over 1 cup. Review the fact that there are 4 cups in a quart and 1000 milliliters in a liter. Because 250 milliliters is just a little more than a cup, a liter is a little more than a quart.*

2. Show students a copy of the Estimate, Order & Measure instructions and record sheet. Review the instructions with the class, and model the procedure of estimating and measuring as needed. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

Estimate, Order & Measure Instructions

To do this activity, you'll need

★ Activity Instructions

★ Estimate, Order & Measure Milliliters & Liters Record Sheet

★ 6 plastic containers labeled with letters A–F

★ pitcher

★ 1-cup measuring cup

★ towel

Instructions for Estimate, Order & Measure: Milliliters & Liters

1 Record your name and the date at the top of a record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.

2 Look at the 6 containers. Put them in the order you think they belong, from smallest to largest. Record your predictions.

3 Go to the sink with your partner and carefully measure 1–2 liters of water into the pitcher.

4 Estimate the capacity of Container A in milliliters or liters. (Remember that there are 1,000 milliliters in a liter, and the measuring cup holds 250 milliliters.) Record your estimate.

5 Use the water and the measuring cup to find out how much water Container A actually holds (to the nearest 10 milliliters). Record the actual capacity.

6 Find the difference between your estimate and the actual capacity. Record the difference in the last column.

7 Continue estimating, finding the capacity, and finding the difference for the other 5 containers. Use what you know about the capacity of the first container to help make your estimates.

8 When you've found out how much each container actually holds, put them in order from smallest to largest, and record their actual ranking.

9 Clean up. After you finish the activity, return all the water to the pitcher and empty the pitcher in the sink. Wipe down the table surface and clear any spills on the floor. Mix up the 6 containers so they're out of order and ready for the next pair of students.

NAME _____ **DATE** _____

Estimate, Order & Measure Record Sheet

Put the containers in the order you think they belong, from smallest to largest. Record your predictions. Then do the second part of the sheet. After you find out how much water each container holds, fill in the second row on this chart to show their actual order.

	1st smallest	2nd	3rd	4th	5th	6th largest
Estimate						
Actual Rank						

Container	Your estimate (to the nearest 10mL)	Actual Measurement (to the nearest 10mL)	The Difference (to the nearest 10mL)
A			
B			
C			
D			
E			
F			

Set D3 ★ Activity 2

ACTIVITY

Which Container is Best?

Overview

Students estimate which beverage containers are most likely to hold certain amounts of water. Then they test their ideas to find the best containers for several different situations. This activity is designed for use by student pairs during Work Places or other work periods.

Skills & Concepts

★ estimate and measure capacity in metric units

★ carry out simple conversations within a system of measurement, such as milliliters to liters

You'll need

★ Which Container is Best? Record Sheets (pages D3.7 and D3.8, run a class set)

★ an assortment of 8 or more beverage containers (see Advance Preparation)

★ 1-cup liquid measuring cup (see Advance Preparation)

★ pitcher to hold about 2 liters of water

★ cafeteria tray

★ towel

Advance Preparation Gather 8 or more beverage containers of varying capacity (e.g., pop can, water bottles of various sizes, small children's cup, drink containers from restaurants including an extra large or "super" size, and so on). Label each container with an alphabet letter. Find the 1-cup measure that came with your Number Corner materials. If you haven't done so already, use the Calibration Strip on Number Corner Blackline 7.5 to calibrate the cup in increments of 10 milliliters. Place the containers, measuring cup, and pitcher of water on a cafeteria tray. Set up the tray, towel, and Record Sheets in a location somewhere in the classroom where pairs of students can work independently over the next few weeks as time allows.

Instructions for Which Container is Best?

1. Explain that you've set up some materials to give students more practice estimating and measuring capacity in metric units. Show them a copy of the Which Container is Best? Record Sheets. Review the instructions on the sheet with the class, and model the procedure of estimating and measuring as needed.

2. Let students know where to find the materials and explain that they'll be working in pairs to do this activity. Explain how they'll know when it's their turn, and establish any ground rules for using the materials, turning in their work, and so on.

Activity 2 Which Container is Best? (cont.)

INDEPENDENT WORKSHEET

See Set D3 Independent Worksheet 1 for more practice estimating and measuring capacity in metric units.

NAME _____ **DATE** _____

Which Container Is Best? Record Sheet page 1 of 2

Directions

a Record your name and the date at the top of the record sheet. Choose a partner to work with. You'll both fill out your own record sheets for this activity.

b For each problem below:

- estimate and record which containers you think will hold the amount of water needed. (It's okay if you choose more than one container that might work.)
- test your estimates using the liquid measuring cup.
- decide which beverage container actually works best.
- record your recommendation.

c Clean up. After you finish the activity, return all the water to the pitcher. Wipe down the table surface and clean up any spills on the floor.

Problems

Sarah needs to bring some water for several different activities this week. Help her choose the best container for each activity.

1 For a car trip to her grandma's on Monday, Sarah needs to bring about 500 milliliters of water to drink.

a Estimate: Which of the containers look like they would hold about 500 milliliters?

b Use the liquid measuring cup to help you find the drink container that would work best for the car trip.

c Container _____ holds about 500 milliliters.

2 For ballet class on Wednesday, Sarah needs to bring about 800 milliliters of water to drink.

a Estimate: Which of the containers look like they would hold about 800 milliliters? Are there any two containers that look like they would hold 800 milliliters combined?

b Use the liquid measuring cup to help you find the drink container (or pair of containers) that would work best for ballet class.

c Container(s) _____ hold(s) about 800 milliliters.

Which Container Is Best? Record Sheet page 2 of 2

3 For her track meet on Saturday, Sarah needs to bring about a liter of water to drink.

a Estimate: Which of the containers look like they would hold about 1 liter? Are there any combinations of 2 or more containers that might hold 1 liter?

b Use the liquid measuring cup to help you find the drink container (or combination of containers) that would work best for the track meet.

c Container(s) _____ hold(s) about 1 liter.

CHALLENGE

4 On the way home from track meets, Sarah always buys a 2-liter bottle of juice. How many total milliliters of juice is she drinking if there are 6 track meets this season?

NAME _____ **DATE** _____

Set D3 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

Capacity in Daily Life

1 Javier brought a thermos of tomato soup for lunch. He estimates that he brought about $\frac{3}{4}$ of a liter. His friend insists he brought about $\frac{3}{4}$ of a milliliter. Who is correct? Why? You may use measuring tools from your classroom to help you, if needed. Explain your answer using numbers, pictures, and/or words.

2 Julene is making fruit punch for her scout troup. There are 10 girls in the troup and each one will have at least 1 glass of punch. Should she use 2 milliliters, 2 liters, 20 liters, or 200 liters of water? Why? You may use measuring tools from your classroom to help you, if needed. Explain your answer using numbers, pictures, and/or words.

Punch Party

Sasha is having a party and needs to buy the ingredients for the punch. Three friends are coming to the party. She plans to have enough punch so that she and each friend can have 4 cups. How many gallons of punch should she buy from the grocery store?

Websites for Capacity Lesson

Day 1:

All metric measurement terms:

http://www.bgfl.org/bgfl/custom/resources_ftp/client_ftp/ks2/maths/measures/index.htm

Day 2:

Metric capacity practice:

http://www.bbc.co.uk/skillswise/game/ma23capa-game-taking-measures-capacity

Day 3:

Metric conversion practice:

http://www.iboard.co.uk/iwb/115

Day 4:

Metric conversion concentration:

http://sheppardsoftware.com/mathgames/measurement/MeasurementLiters.htm