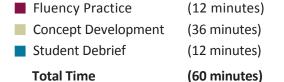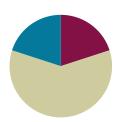# Lesson 6

Objective: Solve problems involving mixed units of capacity.

Suggested Lesson Structure

■ Fluency Practice   (12 minutes)
■ Concept Development   (36 minutes)
■ Student Debrief   (12 minutes)
  Total Time   **(60 minutes)**

Fluency Practice (12 minutes)

▪ Grade 4 Core Fluency Differentiated Practice Sets **4.NBT.4**   (4 minutes)
▪ Add Mixed Numbers **4.NF.3c**   (4 minutes)
▪ Convert Capacity Units **4.MD.2**   (4 minutes)

Grade 4 Core Fluency Differentiated Practice Sets (4 minutes)

Materials: (S) Core Fluency Practice Sets (Lesson 2 Core Fluency Practice Sets)

Note: During Module 7, each day's Fluency Practice may include an opportunity for mastery of the addition and subtraction algorithm by means of the Core Fluency Practice Sets. The process is detailed and Practice Sets are provided in Lesson 2.

Add Mixed Numbers (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity anticipates today's lesson by adding fractional units directly relevant to the measurement units within the lesson: $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$. Direct students to respond chorally or with a written response.

> T: 3 fourths + 2 fourths is how many fourths?
> S: 5 fourths.
> T: Express 5 fourths as ones and fourths.
> S: 1 and 1 fourth.
> T: 3 fourths + 3 fourths is how many fourths?
> S: 6 fourths.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Fluency drills are fun, fast-paced math games, but English language learners may struggle to keep up. Some students may not understand how to respond to, "Express 5 fourths as ones and fourths." Provide an example, coupling language with visual aids or gestures, check for understanding, and, if necessary, explain in the students' first language.

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T: Express 6 fourths as ones and fourths.

S: 1 and 2 fourths.

Continue with the following possible sequence: $\frac{1}{2} + \frac{4}{2}$, $\frac{3}{8} + \frac{7}{8}$, $\frac{5}{8} + \frac{6}{8}$, $\frac{7}{8} + \frac{7}{8}$.

Convert Capacity Units (4 minutes)

Note: This fluency activity reviews Lesson 2 and anticipates work with capacity units.

T: Express each number of gallons and quarts as quarts.

T: 1 gallon.

S: 4 quarts.

T: 1 gallon 1 quart.

S: 5 quarts.

T: 1 gallon 3 quarts.

S: 7 quarts.

T: 2 gallons.

S: 8 quarts.

T: Express each number of quarts as gallons and quarts if possible.

T: 4 quarts is …?

S: 1 gallon.

T: 8 quarts is …?

S: 2 gallons.

Repeat the process with quarts and pints and then gallons and pints.

Concept Development (36 minutes)

Materials: (S) Personal white board

Problem 1: Add mixed units of capacity.

T: 2 cats + 3 cats is …?

S: 5 cats.

T: 2 fourths + 3 fourths is …?

S: 5 fourths.

MP.7

T: Express 5 fourths as a mixed number.

S: 1 and 1 fourth.

T: 2 quarts + 3 quarts is …?

S: 5 quarts.

T: Express 5 quarts as gallons and quarts.

S: 1 gallon 1 quart.

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T: Here are two different ways of adding 2 quarts and 3 quarts. Analyze them with your partner.

MP.7

S: Solution A makes 1 gallon first by adding on 2 quarts. → Solution B adds the quarts together and then takes out 1 gallon from 5 quarts. → Solution A completes a gallon just like if we were adding $\frac{2}{4}$ and $\frac{3}{4}$ and made one by adding $\frac{2}{4}$. → Solution B is like adding $\frac{2}{4}$ and $\frac{3}{4}$, getting $\frac{5}{4}$, and then taking out $\frac{4}{4}$ to get one and 1 fourth.

T: Yes, we can either complete a gallon first and then add on the remaining quarts or add to get 5 quarts and then rename to make 1 gallon and 1 quart.

Allow students to choose a method to solve and express the following sums with mixed units:

- 3 quarts + 3 quarts
- 2 cups + 3 cups
- 3 pints + 4 pints

> **NOTES ON MULTIPLE MEANS OF ENGAGEMENT:**
>
> Today's lesson of partner work and discussion fosters collaboration and communication that is valuable to students working below grade level because it may increase opportunities for one-on-one support and sustained engagement. Some learners may benefit from clear guidance in working effectively with others. Successful engagement comes by providing clear roles and responsibilities for partners or rubrics and norms that communicate partner work expectations.

T: Here are two different ways of adding 5 gallons 2 quarts + 3 quarts. Analyze them with a partner.

S: Solution C makes 1 gallon first by counting up 2 quarts to get 6 gallons and then adding on the extra quart. → Solution D adds the quarts together to get 5 gallons 5 quarts and then takes out one gallon from 5 quarts. → It's like adding mixed numbers—we add the like units.

Allow students to choose a method to solve and express the following sums with mixed units:

- 3 gallons 1 quart + 3 quarts
- 17 quarts 3 cups + 3 cups
- 4 gallons 7 pints + 7 pints

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T: Here are two different ways of adding 5 gallons 2 quarts + 4 gallons 3 quarts. Analyze them with a partner.

S: Solution E adds on the gallons first to get 9 gallons, then adds 2 quarts to make another gallon, and finally adds the one left over quart. → Solution F adds gallons first to get 9 gallons and then makes the next gallon to get 10 gallons 1 quart. → It's just like adding mixed numbers! Add the ones and then add the smaller units. → This time, Solution F just added like units to get 9 gallons 5 quarts and then took out the gallon from the 5 quarts.

Allow students to choose a method to solve and express the following sums with mixed units:

- 3 gallons 1 quart + 6 gallons 3 quarts
- 17 quarts 3 cups + 2 quarts 3 cups
- 4 gallons 7 pints + 10 gallons 7 pints

Problem 2: Subtract mixed units of capacity.

T: 4 cats – 3 cats is …?

S: 1 cat.

T: 4 fourths – 3 fourths is …?

S: 1 fourth.

T: (Write $1 - \frac{3}{4}$.) 1 minus 3 fourths is …?

S: 1 fourth.

T: (Directly below, write $8 - \frac{3}{4}$.) $8 - \frac{3}{4}$ is …?

S: $7\frac{1}{4}$.

T: Here are two different subtraction problems. Solve them with your partner, and then compare how they are similar to each other and to the problems you just solved with the fourths.

S: 1 quart – 3 cups = 1 cup. 8 quarts – 3 cups = 7 quarts 1 cup. → You have to change 1 quart for 4 cups so you can subtract the cups. → It's like subtracting a fraction from a whole number, too. Actually, cups are like fourths in this problem! It takes 4 cups to make a quart just like it takes 4 fourths to make 1. So, you can change 1 quart to 4 cups just like you change 1 to 4 fourths.

Have students solve the following:

- 1 gallon – 1 pint
- 8 gallons – 1 pint
- 1 quart – 2 cups
- 6 quarts – 2 cups

T: Here are two more subtraction problems. Solve them with your partner, and then compare them. How are they different? How are they the same?

Problem 3

$8qt\ 1c - 3c$

$7qt\quad 5c$

Problem 4

$8qt\ 1c - 6qt\ 3c$

$7qt\quad 5c$

S: Problem 3 is a little trickier than Problem 2 because there is an extra cup. So, when you take 4 cups out of 8 quarts and 1 cup, you get 7 quarts and 5 cups because 4 cups + 1 cup is 5 cups. Now, you can subtract 3 cups. → In Problem 4, you have to subtract quarts, too, so just subtract like units. 7 quarts – 6 quarts is 1 quart. 5 cups – 3 cups is 2 cups. The answer is 1 quart 2 cups.

Have students solve the following:

- 9 gallons 2 quarts – 4 quarts
- 12 quarts 1 cup – 5 quarts 2 cups
- 6 gallons 3 pints – 2 gallons 7 pints

Note: Depending on how students are doing with the addition and subtraction of mixed capacity units, introduce compensation and counting up as exemplified below in the context of solving 8 quarts 1 cup – 6 quarts 3 cups. Solution A simply adds a cup to both the subtrahend and minuend (compensation). Solution B shows counting up from the subtrahend to the minuend.

Solution A

$8qt\ 1c - 6qt\ 3c = 8qt\ 2c - 7qt$

Solution B

$6qt\ 3c \xrightarrow{+1c} 7qt \xrightarrow{1qt\ 1c} 8qt\ 1c$

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

Student Debrief (12 minutes)

Lesson Objective: Solve problems involving mixed units of capacity.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.
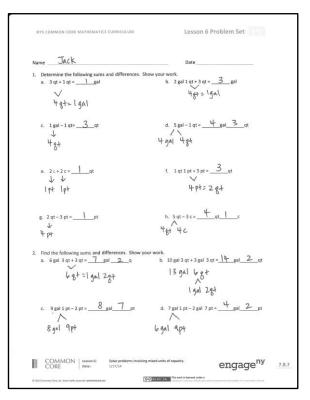
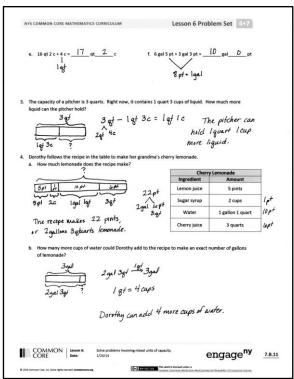Any combination of the questions below may be used to lead the discussion.

- What pattern did you notice between Problems 2(a) and 2(b)?

- When adding mixed units, we used two different strategies: adding like units and counting up with the arrow way. Was one strategy more effective? Did you prefer one strategy to another? Why?

- Explain to your partner how you solved Problem 4(a). Which strategy did you use for each of the ingredients?

- What was similar about working with gallons and quarts and quarts and cups?

- How is adding $5\frac{3}{4} + 7\frac{3}{4}$ like solving 5 gallons 3 quarts + 7 gallons 3 quarts?

- How is subtracting $5\frac{1}{8} - 2\frac{7}{8}$ like solving 5 gallons 1 pint – 2 gallons 7 pints?

- Compare using compensation to solve 81 – 29 or $8\frac{1}{4} - 2\frac{3}{4}$ to using compensation to solve 8 gallons 1 quart – 2 gallons 3 quarts.

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Name _____   Date _____

1. Determine the following sums and differences. Show your work.

    a. 3 qt + 1 qt = _____ gal

    b. 2 gal 1 qt + 3 qt = _____ gal

    c. 1 gal – 1 qt = _____ qt

    d. 5 gal – 1 qt = _____ gal _____ qt

    e. 2 c + 2 c = _____ qt

    f. 1 qt 1 pt + 3 pt = _____ qt

    g. 2 qt – 3 pt = _____ pt

    h. 5 qt – 3 c _____ qt _____ c

2. Find the following sums and differences. Show your work.

    a. 6 gal 3 qt + 3 qt = _____ gal _____ qt

    b. 10 gal 3 qt + 3 gal 3 qt = _____ gal _____ qt

    c. 9 gal 1 pt – 2 pt = _____ gal _____ pt

    d. 7 gal 1 pt – 2 gal 7 pt = _____ gal _____ pt

    e. 16 qt 2 c + 4 c = _____ qt _____ c

    f. 6 gal 5 pt + 3 gal 3 pt = _____ gal _____ pt

3. The capacity of a pitcher is 3 quarts. Right now, it contains 1 quart 3 cups of liquid. How much more liquid can the pitcher hold?

4. Dorothy follows the recipe in the table to make her grandma's cherry lemonade.

    a. How much lemonade does the recipe make?

Cherry Lemonade	
Ingredient	Amount
Lemon Juice	5 pints
Sugar Syrup	2 cups
Water	1 gallon 1 quart
Cherry Juice	3 quarts

    b. How many more cups of water could Dorothy add to the recipe to make an exact number of gallons of lemonade?

Name _____   Date _____

1. Find the following sums and differences. Show your work.

   a.   7 gal 2 qt + 3 gal 3 qt = _____ gal _____ qt

   b.   9 gal 1 qt – 5 gal 3 qt = _____ gal _____ qt

2. Jason poured 1 gallon 1 quart of water into an empty 2-gallon bucket. How much more water can be added to reach the bucket's 2-gallon capacity?

Name _____   Date _____

1. Determine the following sums and differences. Show your work.

   a. 5 qt + 3 qt = _____ gal

   b. 1 gal 2 qt + 2 qt = _____ gal

   c. 1 gal – 3 qt = _____ qt

   d. 3 gal – 2 qt = _____ gal _____ qt

   e. 1 c + 3 c = _____ qt

   f. 2 qt 3 c + 5 c = _____ qt

   g. 1 qt – 1 pt = _____ pt

   h. 6 qt – 5 pt = _____ qt _____ pt

2. Find the following sums and differences. Show your work.

   a. 4 gal 2 qt + 3 qt = _____ gal _____ qt

   b. 12 gal 2 qt + 5 gal 3 qt = _____ gal _____ qt

   c. 7 gal 2 pt – 3 pt = _____ gal _____ pt

   d. 11 gal 3 pt – 4 gal 6 pt = _____ gal _____ pt

   e. 12 qt 5 c + 6 c = _____ qt _____ c

   f. 8 gal 6 pt + 5 gal 4 pt = _____ gal _____ pt

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3. The capacity of a bucket is 5 gallons. Right now, it contains 3 gallons 2 quarts of liquid. How much more liquid can the bucket hold?

4. Grace and Joyce follow the recipe in the table to make a homemade bubble solution.

   a. How much solution does the recipe make?

Homemade Bubble Solution	
Ingredient	**Amount**
Water	2 gallons 3 pints
Dish Soap	2 quarts 1 cup
Corn Syrup	2 cups

   b. How many more cups of solution would they need to fill a 4-gallon container?