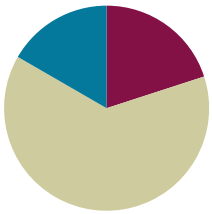
Lesson 14

Objective: Solve word problems involving the addition of measurements in decimal form.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Concept Development	(38 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- State the Value of the Coins **4.MD.2** (2 minutes)
- Add Decimals **4.NF.5** (5 minutes)
- Write in Decimal and Fraction Notation **4.NF.5** (5 minutes)

State the Value of the Coins (2 minutes)

Materials: (S) Personal white board

Note: This fluency activity prepares students for Lessons 15–16.

T: (Write 1 dime = __¢.) What is the value of 1 dime?
S: 10¢.
T: 2 dimes?
S: 20¢.
T: 3 dimes?
S: 30¢.
T: 8 dimes?
S: 80¢.
T: (Write 10 dimes = __ dollar.) Write the number sentence.
S: (Write 10 dimes = 1 dollar.)
T: (Write 20 dimes = __ dollars.) Write the number sentence.
S: (Write 20 dimes = 2 dollars.)
T: (Write 1 penny = __¢.) What is the value of 1 penny?
S: 1¢.

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T: 2 pennies?
S: 2¢.
T: 3 pennies?
S: 3¢.
T: 9 pennies?
S: 9¢.
T: (Write 7 pennies = __¢.) Write the number sentence.
S: (Write 7 pennies = 7¢.)

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

English language learners and others may benefit from a reminder, such as a poster, personal dictionary, or word wall, that defines and provides examples of *standard form, fraction form, unit form,* and *decimal form.* Examples may provide clarity for the Add Decimals fluency activity.

Add Decimals (5 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews Lesson 13.

T: (Write 4 tens + 2 ones.) Say the addition sentence in standard form.
S: 40 + 2 = 42.
T: (Write $\frac{4}{10} + \frac{2}{100} = \frac{\quad}{100}$.) Write the number sentence.
S: (Write $\frac{4}{10} + \frac{2}{100} = \frac{42}{100}$.)
T: (Write $\frac{4}{10} + \frac{2}{100} = \frac{42}{100}$.) Write the number sentence in decimal form.
S: (Write 0.4 + 0.02 = 0.42.)

Continue with the following possible sequence: $\frac{8}{10} + \frac{3}{100}$, $\frac{13}{100} + \frac{2}{10}$, $\frac{5}{10} + \frac{30}{100}$, $\frac{40}{100} + \frac{4}{10}$, $\frac{7}{10} + \frac{30}{100}$, and $\frac{8}{10} + \frac{37}{100}$.

Write in Decimal and Fraction Notation (5 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews Lesson 12.

T: (Write 36.79.) Say the number.
S: 36 and 79 hundredths.
T: Write 36 and 79 hundredths in decimal expanded form without multiplication.
S: (Write 36.79 = 30 + 6 + 0.7 + 0.09.)
T: (Write 36.79 = (_ × 10) + (_ × 1) + (_ × 0.1) + (_ × 0.01).) Complete the number sentence.
S: (Write 36.79 = (3 × 10) + (6 × 1) + (7 × 0.1) + (9 × 0.01).)
T: Write 36 and 79 hundredths in fraction expanded form with multiplication.
S: (Write $36\frac{79}{100} = (3 \times 10) + (6 \times 1) + (7 \times \frac{1}{10}) + (9 \times \frac{1}{100})$.)

Continue with the following possible sequence: 34.09 and 734.80.

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Concept Development (38 minutes)

Materials: (S) Personal white board, Problem Set

Suggested Delivery of Instruction for Solving This Lesson's Word Problems

1. Model the problem.

Have two pairs of students model the problem at the board while the others work independently or in pairs at their seats. Review the following questions before beginning the first problem:

- Can you draw something?
- What can you draw?
- What conclusions can you make from your drawing?

As students work, circulate. Reiterate the questions above. After two minutes, have the two pairs of students share only their labeled diagrams. For about one minute, have the demonstrating students receive and respond to feedback and questions from their peers.

2. Calculate to solve and write a statement.

Give students two minutes to finish their work on that question, sharing their work and thinking with a peer. All should then write their equations and statements of the answer.

3. Assess the solution for reasonableness.

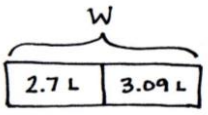
Give students one to two minutes to assess and explain the reasonableness of their solutions.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

In today's lesson, students apply their skill with adding decimals by first converting them to fraction form. The first two problems are single-step problems. Encourage students to use the RDW process because, in doing so, they again realize that part–whole relationships are the same whether the parts are whole numbers, fractions, or mixed numbers.

Problem 1

Barrel A contains 2.7 liters of water. Barrel B contains 3.09 liters of water. Together, how much water do the two barrels contain?



$2.7 = 2\frac{7}{10} = 2\frac{70}{100}$

$3.09 = 3\frac{9}{100}$

Solution A

$W = 2.7\text{ L} + 3.09\text{ L}$

$= 2\frac{70}{100}\text{L} + 3\frac{9}{100}\text{L}$

$= 5\frac{70}{100}\text{L} + \frac{9}{100}\text{L}$

$= 5\frac{79}{100}\text{L}$

$W = 5.79\text{ L}$

Solution B

$2\frac{70}{100} \xrightarrow{+3} 5\frac{70}{100} \xrightarrow{+\frac{9}{100}} 5\frac{79}{100}$

$W = 5.79\text{ L}$

The 2 barrels contain 5.79 Liters of water.

The first problem of the day starts at a simple level to give students the opportunity to simply apply their skill with converting decimal numbers to fraction form to solve a word problem. Students solve this problem by converting 2.7 liters and 3.09 liters to fractional form, converting tenths to hundredths, and adding the mixed numbers. Remind students to convert their answers to decimal form when writing their statements.

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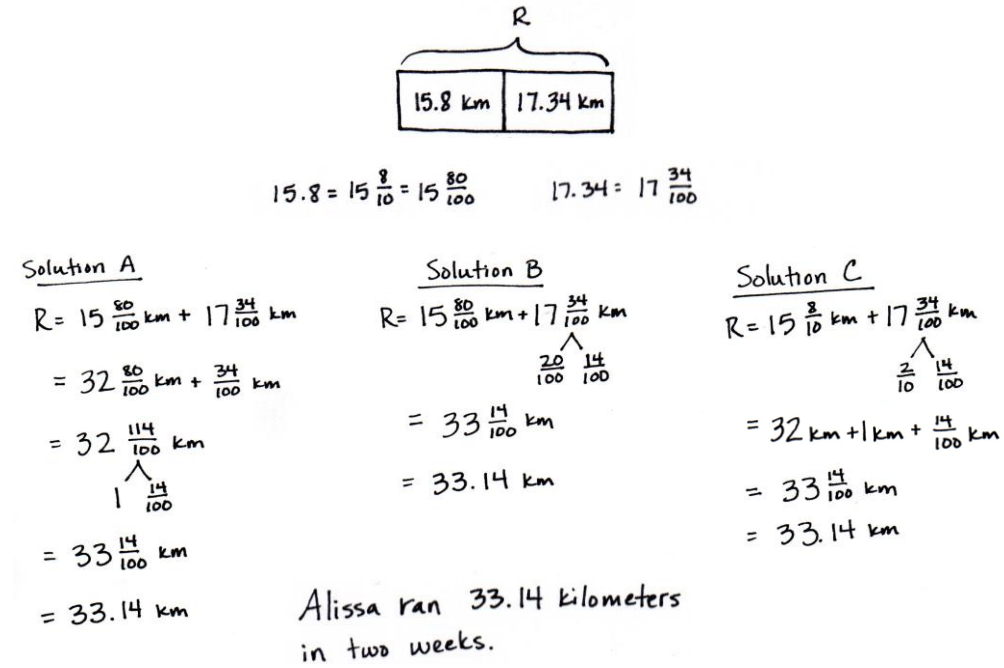
Problem 2

Alissa ran a distance of 15.8 kilometers one week and 17.34 kilometers the following week. How far did she run in the two weeks?



Problem 2 invites various solution strategies because the sum of the fractions is greater than 1, and the whole numbers are larger. In Solution A, students add like units and decompose by drawing a number bond to show $\frac{114}{100}$ as $1 + \frac{14}{100}$ and then adding 32. In Solutions B and C, students use different methods of breaking apart $\frac{34}{100}$ to add up to make 1.

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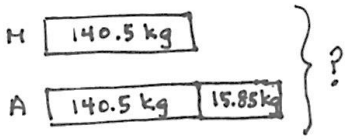
Problem 3

An apple orchard sold 140.5 kilograms of apples in the morning and 15.85 kilograms more apples in the afternoon than in the morning. How many total kilograms of apples were sold that day?



Solution A

$140\frac{5}{10} + 15\frac{85}{100} = 155\frac{50}{100} + \frac{85}{100}$

$= 155\frac{135}{100}$

$= 156\frac{35}{100}$

$140\frac{5}{10} + 156\frac{35}{100} = 296\frac{50}{100} + \frac{35}{100}$

$= 296\frac{85}{100}$

Solution B

$\left(2 \times 140\frac{5}{10}\right) + 15.85 = 280\frac{10}{10} + 15\frac{85}{100}$

$= 296\frac{85}{100}$

The apple orchard sold 296.85 kilograms of apples.

This problem brings the additional complexity of two steps. Students solve this problem by converting 140.5 kilograms and 15.85 kilograms to fractional form, converting tenths to hundredths, and then adding the mixed numbers. Remind students to convert their answers to decimal form and to include the labeled units in their answers. Solution A shows solving for the number of kilograms sold in the afternoon and then solving for the total number of kilograms sold in the day by adding the kilograms of apples from the morning with those from the afternoon. In Solution B, the number of kilograms sold in the morning is multiplied by 2, and then the additional kilograms sold in the afternoon are added.

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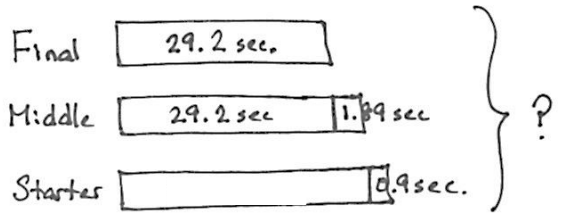
Problem 4

A team of three ran a relay race. The final runner's time was the fastest, measuring 29.2 seconds. The middle runner's time was 1.89 seconds slower than the final runner's. The starting runner's time was 0.9 seconds slower than the middle runner's. What was the team's total time for the race?



Solution A

$29\frac{2}{10} + 1\frac{89}{100} = 29\frac{20}{100} + 1\frac{89}{100}$

$= 30\frac{109}{100}$

$1\frac{9}{100}$

$= 31\frac{9}{100}$

$31\frac{9}{100} + \frac{9}{10} = 31\frac{99}{100}$

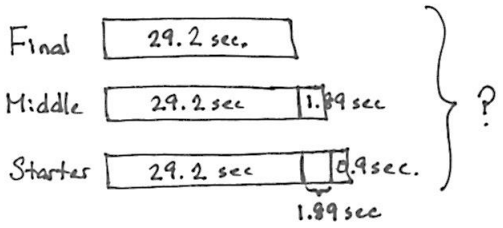
$29\frac{2}{10} + 31\frac{9}{100} + 31\frac{99}{100} = 91\frac{2}{10} + \frac{108}{100}$

$= 91\frac{20}{100} + \frac{108}{100}$

$= 91\frac{128}{100}$

$1\frac{28}{100}$

$= 92\frac{28}{100}$



Solution B

$3 \times 29\frac{2}{10} = (3 \times 29) + (3 \times \frac{2}{10}) = 87\frac{6}{10}$

$1\frac{89}{100} + 1\frac{89}{100} + \frac{9}{10} = 2\frac{178}{100} + \frac{90}{100}$

$1\frac{78}{100}$

$= 3\frac{78}{100} + \frac{90}{100}$

$\frac{68}{100}\ \frac{10}{100}$

$= 4\frac{68}{100}$

$87\frac{6}{10} + 4\frac{68}{100} = 92\frac{28}{100}$

$\frac{4}{10}\ \frac{28}{100}$

The team's total time was 92.28 seconds or 1 minute 32.28 seconds.

This problem involves two additional challenges. First, students must realize that when a runner goes slower, there is more time added on. Second, to find the starting runner's time, students must add the 9 tenths second to the middle runner's time. Notice the difference in Solution A's and Solution B's models. In Solution A, the student finds the time of each individual runner, first adding 1.89 seconds to 29.2 seconds and then adding 0.9 seconds to that sum to find the time of the starting runner. On the other hand, Solution B shows how a student solves by thinking of the starting runner in relationship to the final runner. As a result, she is able to discern the 3 units of 29.2 seconds, multiplies 29.2 by 3, adds $1\frac{89}{100} + 1\frac{89}{100} + \frac{9}{10}$, and adds the two sums together.

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Student Debrief (10 minutes)

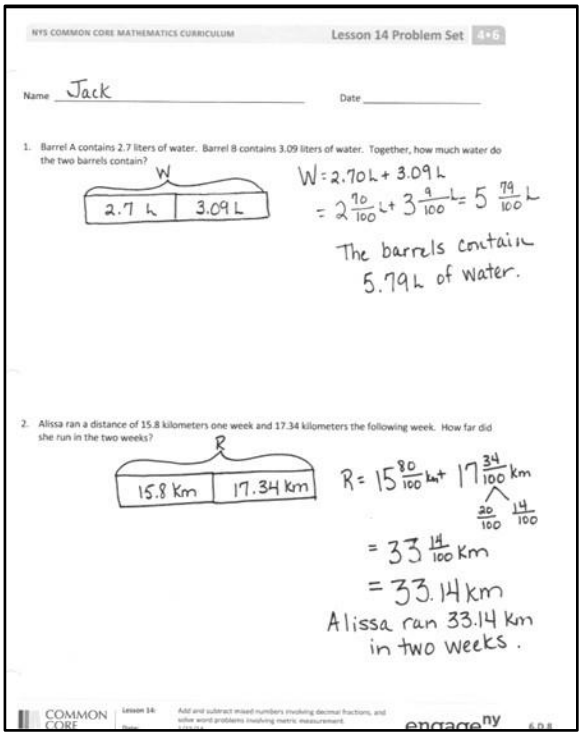
Lesson Objective: Solve word problems involving the addition of measurements in decimal form.

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 was the added complexity of Problem 3? What about Problem 4?
- Explain the strategies that you used to solve Problems 3 and 4.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 14 Problem Set 4•6

Name Jack Date

1. Barrel A contains 2.7 liters of water. Barrel B contains 3.09 liters of water. Together, how much water do the two barrels contain?

$W = 2.70\text{L} + 3.09\text{L}$
$= 2\frac{70}{100}\text{L} + 3\frac{9}{100}\text{L} = 5\frac{79}{100}\text{L}$

The barrels contain 5.79L of water.

2. Alissa ran a distance of 15.8 kilometers one week and 17.34 kilometers the following week. How far did she run in the two weeks?

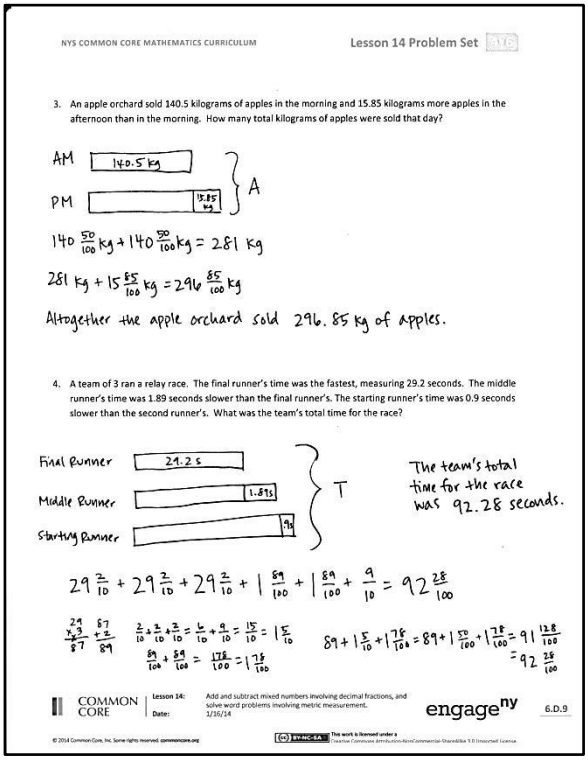
$R = 15\frac{80}{100}\text{km} + 17\frac{34}{100}\text{km}$ ($\frac{20}{100}$ $\frac{14}{100}$)
$= 33\frac{14}{100}\text{km}$
$= 33.14\text{km}$

Alissa ran 33.14 km in two weeks.

COMMON CORE Lesson 14: Add and subtract mixed numbers involving decimal fractions, and solve word problems involving metric measurement. engage^ny 6.D.9

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.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 14 Problem Set 4•6

3. An apple orchard sold 140.5 kilograms of apples in the morning and 15.85 kilograms more apples in the afternoon than in the morning. How many total kilograms of apples were sold that day?

$140\frac{50}{100}\text{kg} + 140\frac{50}{100}\text{kg} = 281\text{ kg}$
$281\text{ kg} + 15\frac{85}{100}\text{kg} = 296\frac{85}{100}\text{kg}$

Altogether the apple orchard sold 296.85 kg of apples.

4. A team of 3 ran a relay race. The final runner's time was the fastest, measuring 29.2 seconds. The middle runner's time was 1.89 seconds slower than the final runner's. The starting runner's time was 0.9 seconds slower than the second runner's. What was the team's total time for the race?

The team's total time for the race was 92.28 seconds.

$29\frac{2}{10} + 29\frac{2}{10} + 29\frac{2}{10} + 1\frac{89}{100} + 1\frac{89}{100} + \frac{9}{10} = 92\frac{28}{100}$

$\frac{29}{\times\ 3}$ $\frac{87}{87}$ $+\ 2$ 89

$\frac{2}{10} + \frac{2}{10} + \frac{2}{10} = \frac{6}{10} + \frac{9}{10} = \frac{15}{10} = 1\frac{5}{10}$
$\frac{89}{100} + \frac{89}{100} = \frac{178}{100} = 1\frac{78}{100}$

$89 + 1\frac{5}{10} + 1\frac{78}{100} = 89 + 1\frac{50}{100} + 1\frac{78}{100} = 91\frac{128}{100} = 92\frac{28}{100}$

COMMON CORE Lesson 14: Date: Add and subtract mixed numbers involving decimal fractions, and solve word problems involving metric measurement. 1/16/14 engage^ny 6.D.9

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Name _____ Date _____

1. Barrel A contains 2.7 liters of water. Barrel B contains 3.09 liters of water. Together, how much water do the two barrels contain?

2. Alissa ran a distance of 15.8 kilometers one week and 17.34 kilometers the following week. How far did she run in the two weeks?

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3. An apple orchard sold 140.5 kilograms of apples in the morning and 15.85 kilograms more apples in the afternoon than in the morning. How many total kilograms of apples were sold that day?

4. A team of three ran a relay race. The final runner's time was the fastest, measuring 29.2 seconds. The middle runner's time was 1.89 seconds slower than the final runner's. The starting runner's time was 0.9 seconds slower than the middle runner's. What was the team's total time for the race?

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Name _____ Date _____

Elise ran 6.43 kilometers on Saturday and 5.6 kilometers on Sunday. How many total kilometers did she run on Saturday and Sunday?

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Name _____ Date _____

1. The snowfall in Year 1 was 2.03 meters. The snowfall in Year 2 was 1.6 meters. How many total meters of snow fell in Years 1 and 2?

2. A deli sliced 22.6 kilograms of roast beef one week and 13.54 kilograms the next. How many total kilograms of roast beef did the deli slice in the two weeks?

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3. The school cafeteria served 125.6 liters of milk on Monday and 5.34 more liters of milk on Tuesday than on Monday. How many total liters of milk were served on Monday and Tuesday?

4. Max, Maria, and Armen were a team in a relay race. Max ran his part in 17.3 seconds. Maria was 0.7 seconds slower than Max. Armen was 1.5 seconds slower than Maria. What was the total time for the team?

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