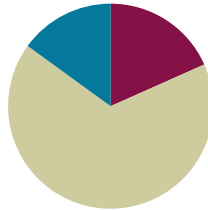


## Lesson 4

**Objective:** Solve multiplicative comparison word problems using measurement conversion tables.

### Suggested Lesson Structure

■ Fluency Practice	(11 minutes)
■ Concept Development	(40 minutes)
■ Student Debrief	(9 minutes)
<b>Total Time</b>	<b>(60 minutes)</b>



### Fluency Practice (11 minutes)

- Grade 4 Core Fluency Differentiated Practice Sets **4.NBT.4** (4 minutes)
- Convert Length Units **4.MD.1** (4 minutes)
- Convert Weight Units **4.MD.1** (3 minutes)

### Grade 4 Core Fluency Differentiated Practice Sets (4 minutes)

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

Note: During Topic A and for the remainder of the year, 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.

### Convert Length Units (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews Lesson 1 and metric conversions from Module 2.

T: (Write 1,000 m.) 1,000 m is the same as 1 of what unit?

S: 1 kilometer.

T: (Write 1,000 m = 1 km.)

Repeat the process for 2,000 and 3,000 meters.

T: (Write 6,000 m = \_\_\_ km.) Write the number sentence.

S: (Write 6,000 m = 6 km.)

T: (Write 100 cm.) 100 cm is the same as 1 of what unit?

S: 1 meter.

T: (Write  $100\text{ cm} = 1\text{ m.}$ )

Repeat the process for 200 and 300 meters.

T: (Write  $700\text{ cm} = \underline{\hspace{1cm}}\text{ m.}$ ) Write the number sentence.

S: (Write  $700\text{ cm} = 7\text{ m.}$ )

T: (Write 3 ft.) 3 feet is the same as 1 of what unit?

S: 1 yard.

T: (Write  $3\text{ ft} = 1\text{ yd.}$ )

Repeat the process for 6 and 9 yards.

T: (Write  $21\text{ ft} = \underline{\hspace{1cm}}\text{ yd.}$ ) Write the number sentence.

S: (Write  $21\text{ ft} = 7\text{ yd.}$ )

T: (Write 12 in.) 12 inches is the same as 1 of what unit?

S: 1 foot.

T: (Write  $12\text{ in} = 1\text{ ft.}$ )

Repeat the process for 24 and 36 inches.

### Convert Weight Units (3 minutes)

Materials: (T) Personal white board

Note: This fluency activity reviews Lesson 1 and metric conversions from Module 2.

T: (Write 1,000 g.) 1,000 g is the same as 1 of what unit?

S: 1 kg.

T: (Write  $1,000\text{ g} = 1\text{ kg.}$ )

Repeat the process for 2,000 and 3,000 grams.

T: (Write 16 oz.) 16 ounces is the same as 1 of what unit?

S: 1 pound.

T: (Write  $16\text{ oz} = 1\text{ lb.}$ )

Repeat the process for 32 and 48 ounces.

**Concept Development (40 minutes)**

Materials: (S) Problem Set

**Suggested Delivery of Instruction for Solving Lesson 4’s Word Problems**

For Problems 1–5, students may work in pairs to solve each of the problems using the RDW approach to problem solving. These problems are also found in the Problem Set.

**1. Model the problem.**

Select two pairs of students who can be successful with modeling the problem to work at the board while the other students 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.**

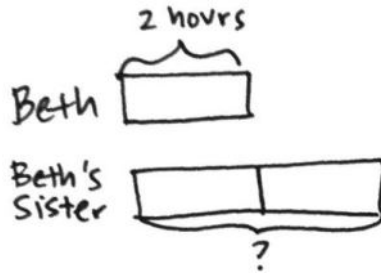
Allow students two minutes to complete work on the problem, sharing their work and thinking with a peer. Have students write their equations and statements of the answer.

**3. Assess the solution.**

Give students one to two minutes to assess the solutions presented by their peers on the board, comparing the solutions to their own work. Highlight alternative methods to reach the correct solution.

**Problem 1**

Beth is allowed 2 hours of TV time each week. Her sister is allowed 2 times as much. How many minutes of TV can Beth’s sister watch?



Solution A

$$2 \times 60 \text{ minutes} = 120 \text{ minutes}$$

$$2 \times 120 \text{ minutes} = 240 \text{ minutes}$$

Solution B

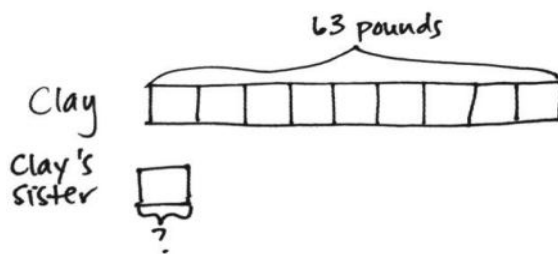
$$4 \times 60 \text{ minutes} = 240 \text{ minutes}$$

Beth's sister is allowed to watch 240 minutes of TV each week.

This two-step problem requires students to determine the number of hours Beth’s sister is allowed to watch TV and then use that information to determine the time in minutes. In Solution A, students solve for the number of minutes in 1 unit by multiplying 60 minutes by 2. Then, they multiply 120 minutes by 2 to solve for the number of minutes Beth’s sister watches TV. In Solution B, students recognize 2 units as 4 hours, multiplying 4 by 60 minutes to solve for 240 minutes.

**Problem 2**

Clay weighs 9 times as much as his baby sister. Clay weighs 63 pounds. How much does his baby sister weigh in ounces?



Solution A

$$63 \text{ pounds} \div 9 = 7 \text{ pounds}$$

$$7 \times 16 \text{ ounces} = 112 \text{ ounces}$$

$$\begin{array}{r} 16 \\ \times 7 \\ \hline 112 \end{array}$$

$$63 \times 16 \text{ ounces} = 1008 \text{ ounces}$$

$$1008 \text{ ounces} \div 9 = 112 \text{ ounces}$$

$$\begin{array}{r} 63 \\ \times 16 \\ \hline 378 \\ + 630 \\ \hline 1008 \end{array}$$

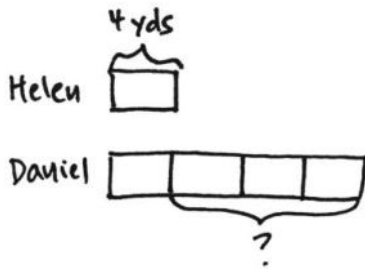
$$\begin{array}{r} 112 \\ 9 \overline{)1008} \\ \underline{-9} \phantom{00} \\ 100 \phantom{0} \\ \underline{-90} \phantom{0} \\ 108 \phantom{0} \\ \underline{-99} \phantom{0} \\ 90 \\ \underline{-81} \\ 18 \\ \underline{-18} \\ 0 \end{array}$$

Clay's sister weighs 112 ounces.

In Solution A, students first determine Clay’s sister’s weight in pounds by dividing by 9. Then, they convert pounds to ounces to get 112 ounces. In Solution B, students determine Clay’s weight in ounces first. Next, they divide his weight in ounces by 9 to solve for 112 ounces. Notice that Solution A is more efficient and requires fewer paper-and-pencil calculations overall, but both strategies reach a correct solution.

**Problem 3**

Helen has 4 yards of rope. Daniel has 4 times as much rope as Helen. How many more feet of rope does Daniel have than Helen?



Solution A

$$4 \times 3 \text{ feet} = 12 \text{ feet}$$

$$3 \times 12 \text{ feet} = 36 \text{ feet}$$

Solution B

$$4 \times 4 \text{ yards} = 16 \text{ yards}$$

$$16 - 4 = 12$$

$$12 \times 3 \text{ feet} = 36 \text{ feet}$$

Daniel has 36 more feet of rope than Helen.

In Solution A, students convert Helen’s rope from yards to feet first. Then they multiply by 3 to find the value of 3 units; the difference is clearly shown in the model. In Solution B, students determine the number of yards in Daniel’s rope by first multiplying by 4. They subtract the length of Helen’s rope from Daniel’s rope to find the difference. Finally, they convert 12 yards to feet by multiplying by 3. Again, have students notice the greater efficiency of Solution A.



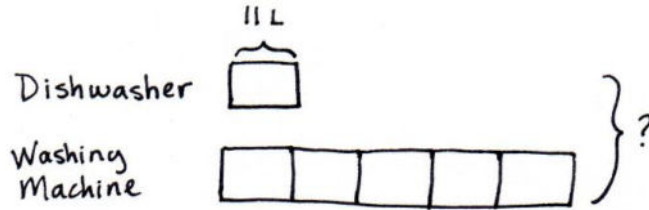
**NOTES ON MULTIPLE MEANS OF REPRESENTATION:**

In addition to the tape diagram, learners can construct a conversion table to solve Problem 3, such as the following:

Liters	Milliliters
1	1,000
5	5,000
10	10,000
50	

**Problem 4**

A dishwasher uses 11 liters of water for each cycle. A washing machine uses 5 times as much water as a dishwasher uses for each load. Combined, how many milliliters of water are used for 1 cycle of each machine?



Solution A

$$5 \times 11 \text{ L} = 55 \text{ L}$$

$$55 \text{ L} + 11 \text{ L} = 66 \text{ L}$$

$$66 \times 1,000 \text{ mL} = 66,000 \text{ mL}$$

Solution B

$$6 \times 11 \text{ L} = 66 \text{ L}$$

$$66 \times 1,000 \text{ mL} = 66,000 \text{ mL}$$

Solution C

$$11 \text{ L} = 11,000 \text{ mL}$$

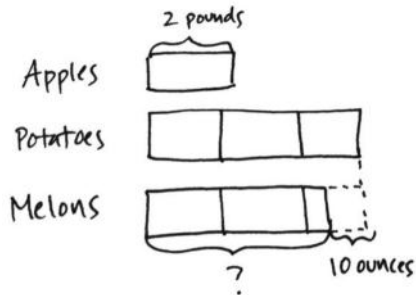
$$11,000 \text{ mL} \times 6 = 66,000 \text{ mL}$$

Combined, both machines use 66,000 mL water for 1 cycle.

Solution A allows students to determine the amount of water used by the washing machine first by multiplying 11 liters by 5 to get 55 liters and then by adding the water used by the dishwasher, 11 liters, to find that both machines use 66 liters of water. Finally, students convert liters to milliliters by multiplying by 1,000. In Solution B, students solve for a total of 6 units, multiplying 11 liters times 6. Next, students convert to milliliters by multiplying by 1,000. In Solution C, the number of milliliters in 11 liters is found first and then multiplied by 6.

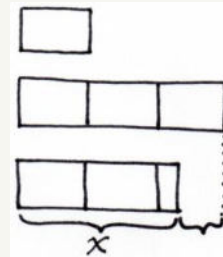
**Problem 5**

Joyce bought 2 pounds of apples. She bought 3 times as many pounds of potatoes as pounds of apples. The melons she bought were 10 ounces lighter than the total weight of the potatoes. How many ounces did the melons weigh?



**NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:**

Students working above grade level may enjoy an open-ended independent challenge. As an alternative to solving Problem 5, students may use the unlabeled tape diagram (as pictured) to write their own word problems. In keeping with the objective, students should include measurement conversions in their word problems.



Solution A

**Potatoes:**  
 $3 \times 2 \text{ pounds} = 6 \text{ pounds}$   
 $6 \times 16 \text{ ounces} = 96 \text{ ounces}$   
 $96 - 10 = 86$

Solution B

**Apples:**  
 $2 \times 16 \text{ ounces} = 32 \text{ ounces}$   
**Potatoes:**  
 $3 \times 32 \text{ ounces} = 96 \text{ ounces}$   
**Melons:**  
 $96 - 10 = 86$

The melons weigh 86 ounces.

MP.2

In Solution A, students first find the weight of the potatoes in pounds by multiplying by 3 and then convert the weight of the potatoes to ounces by multiplying by 16. They then subtract 10 ounces from the potatoes to get 86 ounces. With Solution B, students convert the weight of the apples to ounces first by multiplying by 16. Then, they determine the weight of the potatoes in ounces by multiplying by 3. Finally, they subtract 10 from 96 to get 86 ounces. Look for other plausible solutions, such as solving for the 2 units of melons and adding on 22 ounces of the next partial unit. Have students assess the reasonableness of their answers by seeing that if their tape diagrams model the weight of the melons as being less than the potatoes but greater than the apples, then their answers also show, paying close attention to the units, that they are comparing.

### Problem Set

Please note that the Problem Set is completed as part of the Concept Development for this lesson.

### Student Debrief (9 minutes)

**Lesson Objective:** Solve multiplicative comparison word problems using measurement conversion tables.

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.

- Share your strategy for solving Problem 3 with your partner. What did your partner do well? What could he or she have done differently?
- How were the set-ups for Problem 3 and Problem 4 similar to each other? How were they different?
- In today’s problems, why do we always have to convert the units?
- At what point in solving Problem 5 did you choose to convert into ounces? Is it better to convert to ounces earlier or at the end? Why?

### Exit Ticket (3 minutes)

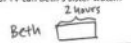

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students’ understanding of the concepts that were presented in today’s lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 4 Problem Set

Name Jack Date \_\_\_\_\_


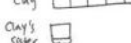
Use the RDW process to solve the following problems.

1. Beth is allowed 2 hours of TV time each week. Her sister is allowed 2 times as much. How many minutes of TV can Beth’s sister watch?

Beth:   
Beth's sister: 



$2 \times 60 \text{ minutes} = 120 \text{ minutes}$   
 $2 \times 120 \text{ minutes} = 240 \text{ minutes}$   
 Beth's sister is allowed to watch 240 minutes of TV each week.

2. Clay weighs 9 times as much as his baby sister. Clay weighs 63 pounds. How much does his baby sister weigh in ounces?

Clay:   
Clay's sister: 

$63 \text{ pounds} \times 16 \text{ ounces} = 1008 \text{ ounces}$   
 $1008 \text{ ounces} \div 9 = 112 \text{ ounces}$   
 Clay's sister weighs 112 ounces.

3. Helen has 4 yards of rope. Daniel has 4 times as much rope as Helen. How many more feet of rope does Daniel have compared to Helen?



Helen:   
Daniel: 

$4 \times 3 \text{ feet} = 12 \text{ feet}$   
 $3 \times 12 \text{ feet} = 36 \text{ feet}$   
 Daniel has 36 more feet of rope than Helen.

COMMON CORE Lesson 4: Solve multiplicative comparison word problems using measurement conversion tables. Date: 1/24/14 engageNY 7.A.3

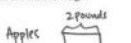
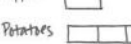

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 4 Problem Set

4. A dishwasher uses 11 liters of water for each cycle. A washing machine uses 5 times as much water as a dishwasher uses for each load. Combined, how many milliliters of water are used for 1 cycle of each machine?

Dishwasher:   
Washing Machine: 

$11 \text{ L} = 11,000 \text{ mL}$   
 $11,000 \text{ mL} \times 6 = 66,000 \text{ mL}$   
 Combined, both machines use 66,000 mL water for 1 cycle.

5. Joyce bought 2 pounds of apples. She bought 3 times as many pounds of potatoes as pounds of apples. The melons she bought were 10 ounces lighter than the total weight of the potatoes. How many ounces did the melons weigh?

Apples:   
Potatoes:   
Melons: 

Apples:  $2 \times 16 \text{ ounces} = 32 \text{ ounces}$   
 Potatoes:  $3 \times 32 \text{ ounces} = 96 \text{ ounces}$   
 Melons:  $96 - 10 = 86$   
 The melons weigh 86 ounces.

COMMON CORE Lesson 4: Solve multiplicative comparison word problems using measurement conversion tables. Date: 1/24/14 engageNY 7.A.3





4. A dishwasher uses 11 liters of water for each cycle. A washing machine uses 5 times as much water as a dishwasher uses for each load. Combined, how many milliliters of water are used for 1 cycle of each machine?
5. Joyce bought 2 pounds of apples. She bought 3 times as many pounds of potatoes as pounds of apples. The melons she bought were 10 ounces lighter than the total weight of the potatoes. How many ounces did the melons weigh?

Name \_\_\_\_\_

Date \_\_\_\_\_

Use RDW to solve the following problem.

Brian has a melon that weighs 3 pounds. He cut it into six equal pieces. How many ounces did each piece weigh?

Name \_\_\_\_\_

Date \_\_\_\_\_

Use RDW to solve the following problems.

1. Sandy took the train to New York City. The trip took 3 hours. Jackie took the bus, which took twice as long. How many minutes did Jackie's trip take?

2. Coletton's puppy weighed 3 pounds 8 ounces at birth. The vet weighed the puppy again at 6 months, and the puppy weighed 7 pounds. How many ounces did the puppy gain?

3. Jessie bought a 2-liter bottle of juice. Her sister drank 650 milliliters. How many milliliters were left in the bottle?

4. Hudson has a chain that is 1 yard in length. Myah's chain is 3 times as long. How many feet of chain do they have in all?
5. A box weighs 8 ounces. A shipment of boxes weighs 7 pounds. How many boxes are in the shipment?
6. Tracy's rain barrel has a capacity of 27 quarts of water. Beth's rain barrel has a capacity of twice the amount of water as Tracy's rain barrel. Trevor's rain barrel can hold 9 quarts of water less than Beth's barrel.
- a. What is the capacity of Trevor's rain barrel?
- b. If Tracy, Beth, and Trevor's rain barrels were filled to capacity, and they poured all of the water into a 30-gallon bucket, would there be enough room? Explain.