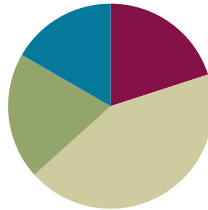


Lesson 13

Objective: Use whole number multiplication to express equivalent measurements.

Suggested Lesson Structure

■ Fluency Practice	(12 minutes)
■ Application Problem	(12 minutes)
■ Concept Development	(26 minutes)
■ Student Debrief	(10 minutes)
Total Time	(60 minutes)



Fluency Practice (12 minutes)

- Multiply by 0.1, 0.01, and 0.001 **5.NBT.2** (2 minutes)
- Multiply Using the Area Model **5.NBT.2** (7 minutes)
- Unit Conversions **5.MD.1** (3 minutes)

Multiply by 0.1, 0.01, and 0.001 (2 minutes)

Note: This fluency activity prepares students to multiply by decimal fractions in today's lesson.

T: (Write $30 \times 0.1 = \underline{\quad}$.) Say the answer.

S: 3.

Repeat the process for the following possible sequence: 300×0.01 , $3,000 \times 0.001$, $5,000 \times 0.001$, 50×0.1 , 500×0.01 , $5,000 \times 0.01$, $3,000 \times 0.01$, $30,000 \times 0.001$, $50,000 \times 0.001$, 40×0.1 , 400×0.1 , $4,000 \times 0.1$, $40,000 \times 0.1$, 700×0.01 , $7,000 \times 0.01$, $70,000 \times 0.01$, $700,000 \times 0.01$, and $7,000,000 \times 0.001$.

Multiply Using the Area Model (7 minutes)

Follow the same process and procedure as Lesson 6 for the following possible sequence: 5.21×34 and 8.35×73 .

Unit Conversions (3 minutes)

Materials: (S) Personal white board

Note: Review of this fluency activity builds a foundation for upcoming lessons.

T: (Write $1 \text{ ft} = \underline{\quad} \text{ in.}$) 1 foot is the same as how many inches?

S: 12 inches.

Repeat the process for the following possible sequence: 2 ft, 3 ft, 4 ft, 10 ft, 5 ft, 7 ft.

T: (Write $100 \text{ cm} = \underline{\hspace{1cm}} \text{ m}$.) 100 centimeters is the same as how many meters?

S: 1 meter.

Repeat the process for the following possible sequence: 200 cm, 300 cm, 600 cm, 800 cm, 900 cm.

Application Problem (12 minutes)

Materials: (S) Meter strip (Template); one string either 9 cm, 20 cm, 75 cm, or 105 cm

Procedure: Pass out a string to each student so that partners have different-length strings. Have them measure their strings and express the measurement in meters, centimeters, and millimeters, as well as share their measurements with their partners. Record the measurements of the strings in a class chart and revisit the following concepts from Lesson 4:

- Although the number of units has changed, the length of the string is the same.
- $1.05 \text{ meters} \times 10^3 = 1,050 \text{ meters}$. This equation makes 1,000 copies of 1.05 meters.
- To convert meters to millimeters, we multiply the *number* of meters by 10^3 . $1.05 \times 10^3 = 1,050$ to find that 1.05 meters = 1,050 millimeters.

	m	cm	mm
A	1.05 m	105 cm	1,050 mm
B	0.75 m	75 cm	750 mm
C	0.2 m	20 cm	200 mm
D	0.09 m	9 cm	90 mm

Note: Today's Application Problem provides a practical, hands-on way for students to experience the conversion reasoning foundational to today's lesson.

Concept Development (26 minutes)

Materials: (S) Meter strip (Template), personal white board

Problem 1

3 weeks = $\underline{\hspace{1cm}}$ days

3 weeks = $3 \times (1 \text{ week})$
 = $3 \times (7 \text{ days})$
 = 21 days

T: (Write $3 \text{ weeks} = 3 \times (1 \text{ week})$ on the board.) Explain to your partner why this is true.

S: 3 weeks is the same as 3 units of 1 week. \rightarrow It's 3 groups of 1 week. \rightarrow It's like last year we saw that 3 fourths is the same as 3 times 1 fourth

T: What are the two factors?

- S: 3 and 1 week.
- T: How many days are equal to 1 week?
- S: 7 days.
- T: So rename 1 week as 7 days.
- T: Let's use parentheses to make it clear that this factor, or **conversion factor**, has the same value. (Write $3 \times (7 \text{ days})$ directly below $3 \times (1 \text{ week})$ so that the equivalence of the two factors is very clear.)
- T: 3 times 7 days is how many days?
- S: 21 days.
- T: So 3 weeks equals how many days?
- S: 21 days.
- T: On your personal white board, take a moment to convert 3 hours to minutes using the same process. Remember to use the parentheses to clarify the renaming of the conversion factor. Review your conversion with your partner.
- T: (Students work.) We converted 3 hours to 180 minutes. Did we convert from a larger unit to a smaller unit or a smaller unit to a larger unit?
- S: Larger to smaller.
- T: Yes. An hour is a larger unit than a minute. Since we converted to a smaller unit, a minute, what happened to the amount of time?
- S: There are more units but the exact same amount of time. \rightarrow The number of units increased, but the time stayed the same.

$$\begin{aligned}
 3 \text{ hours} &= \underline{\hspace{2cm}} \text{ minutes} \\
 3 \text{ hours} &= 3 \times (1 \text{ hour}) \\
 &= 3 \times (60 \text{ minutes}) \\
 &= 180 \text{ minutes}
 \end{aligned}$$

Problem 2

$$1.05 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$$

$$\begin{aligned}
 1.05 \text{ m} &= 1.05 \times (1 \text{ m}) \\
 &= 1.05 \times (100 \text{ cm}) \\
 &= 105 \text{ cm}
 \end{aligned}$$

- T: (Write 1.05 m on the board.) Let's use the same strategy to convert larger units to smaller units, starting with the conversions from our Application Problem.
- T: Let's convert 1.05 meters to centimeters. First, let's rename 1.05 meters as a multiplication expression. Consider how we expressed 3 weeks as an expression. Talk to your partner.
- S: One factor is 1.05, and the other factor is 1 meter. $\rightarrow 1.05 \times 1 \text{ meter}$.
- T: (Write $1.05 \text{ m} = 1.05 \times (1 \text{ m})$.) Let's rename the conversion factor in centimeters. 1 meter equals ...?
- S: 100 centimeters.
- T: (Write $1.05 \text{ m} = 1.05 \times (100 \text{ cm})$.) What is 1.05 times 100 centimeters?
- S: 105 centimeters.

T: Is that the correct conversion? Does 1.05 meters equal 105 centimeters? (Hold up the meter strip, and refer to the chart from the Application Problem.)

Have students convert other string measurements: 0.75 meters, 0.2 meters, and 0.09 meters to centimeters and then millimeters using the strategy.

$$\begin{aligned} 0.09 \text{ m} &= \underline{\hspace{2cm}} \text{ cm} \\ 0.09 \text{ m} &= 0.09 \times (1 \text{ m}) \\ &= 0.09 \times (100 \text{ cm}) \\ &= 9 \text{ cm} \end{aligned}$$

$$\begin{aligned} 0.09 \text{ m} &= \underline{\hspace{2cm}} \text{ mm} \\ 0.09 \text{ m} &= 0.09 \times (1 \text{ m}) \\ &= 0.09 \times (1,000 \text{ mm}) \\ &= 90 \text{ mm} \end{aligned}$$

Problem 3

A crate of apples weighs 5.7 kilograms. Convert the weight to grams.

A sack holds 56.75 pounds of sand. Convert the weight to ounces.

T: Start the process with students. Write the measurement as an equivalent expression with the unit as a factor.

$$\begin{aligned} 5.7 \text{ kg} &= \underline{\hspace{2cm}} \text{ g} \\ 5.7 \text{ kg} &= 5.7 \times (1 \text{ kg}) \\ &= 5.7 \times (1,000 \text{ g}) \\ &= 5,700 \text{ g} \end{aligned}$$

$$\begin{aligned} 56.75 \text{ lb} &= \underline{\hspace{2cm}} \text{ oz} \\ 56.75 \text{ lb} &= 56.75 \times (1 \text{ lb}) \\ &= 56.75 \times (16 \text{ oz}) \\ &= 908 \text{ oz} \end{aligned}$$

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 (10 minutes)

Lesson Objective: Use whole number multiplication to express equivalent measurements.

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.

- In the conversion you completed for Problem 1(d), explain your process as you worked. How did you decide what to multiply by?
- Although we multiplied by 100 to convert 1.05 meters to 105 centimeters, the length remained the same. Why?
- Explain the term **conversion factor**. (The conversion factor is the factor in a multiplication sentence that renames one measurement unit as another equivalent unit.) For example, $14 \times (1 \text{ in}) = 14 \times (\frac{1}{12} \text{ ft})$, 1 in and $\frac{1}{12}$ ft are the conversion factors.
- What would be the conversion factor if we wanted to convert years to days? Years to months? Why isn't there one conversion factor to convert months to days? Why isn't there one conversion factor to convert years to days?
- Can you name some situations in which measurement conversion might be useful and/or necessary?

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 13 Problem Set 5•2

Name Robin Date _____

1. Solve. The first one is done for you.

a. Convert weeks to days. 8 weeks = $8 \times (1 \text{ week})$ = $8 \times (7 \text{ days})$ = 56 days	b. Convert years to days. 4 years = $4 \times (1 \text{ year})$ = $4 \times (365 \text{ days})$ = 1,460 days
c. Convert meters to centimeters. 9.2 m = $9.2 \times (1 \text{ m})$ = $9.2 \times (100 \text{ cm})$ = 920 cm	d. Convert yards to feet. 5.7 yards = $5.7 \times (1 \text{ yard})$ = $5.7 \times (3 \text{ feet})$ = 17.1 feet
e. Convert kilograms to grams. 6.08 kg = $6.08 \times (1 \text{ kg})$ = $6.08 \times (1,000 \text{ g})$ = 6,080 g	f. Convert pounds to ounces. 12.5 pounds = $12.5 \times (1 \text{ lb})$ = $12.5 \times (16 \text{ oz})$ = 200 oz

COMMON CORE Lesson 13: Use whole number multiplication to express equivalent measurements. Date: 7/23/14 engageNY 2.D.7

© 2015 Great Minds. All rights reserved. This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License.

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 13 Problem Set 5•2

2. After solving, write a statement to express each conversion. The first one is done for you.

a. Convert the number of hours in a day to minutes. 24 hours = $24 \times (1 \text{ hour})$ = $24 \times (60 \text{ minutes})$ = 1,440 minutes One day has 24 hours, which is the same as 1,440 minutes.	b. A small female gorilla weighs 68 kilograms. How much does she weigh in grams? $68 \text{ kg} = 68 \times (1 \text{ kg})$ = $68 \times (1,000 \text{ g})$ = 68,000 She weighs 68,000 grams.
c. The height of a man is 1.7 meters. What is his height in centimeters? $1.7 \text{ m} = 1.7 \times (1 \text{ m})$ = $1.7 \times (100 \text{ cm})$ = 170 cm His height is 170 centimeters.	d. The capacity of a syringe is 0.08 liters. Convert this to milliliters. $0.08 \text{ L} = 0.08 \times (1 \text{ L})$ = $0.08 \times (1,000 \text{ mL})$ = 80 mL The capacity of the syringe is 80 milliliters.
e. A coyote weighs 11.3 pounds. Convert the coyote's weight to ounces. $11.3 \text{ lb} = 11.3 \times (1 \text{ lb})$ = $11.3 \times (16 \text{ oz})$ = 180.8 oz The coyote weighs 180.8 ounces.	f. An alligator is 2.3 yards long. What is the length of the alligator in inches? $2.3 \text{ yd} = 2.3 \times (1 \text{ yd})$ = $2.3 \times (36 \text{ in})$ = 82.8 in The length of the alligator is 82.8 inches.

COMMON CORE Lesson 13: Use whole number multiplication to express equivalent measurements. Date: 7/23/14 engageNY 2.D.8

© 2015 Great Minds. All rights reserved. This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License.

Name _____

Date _____

1. Solve. The first one is done for you.

<p>a. Convert weeks to days.</p> $8 \text{ weeks} = 8 \times (1 \text{ week})$ $= 8 \times (7 \text{ days})$ $= 56 \text{ days}$	<p>b. Convert years to days.</p> $4 \text{ years} = \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} \text{ year})$ $= \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} \text{ days})$ $= \underline{\hspace{2cm}} \text{ days}$
<p>c. Convert meters to centimeters.</p> $9.2 \text{ m} = \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} \text{ m})$ $= \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} \text{ cm})$ $= \underline{\hspace{2cm}} \text{ cm}$	<p>d. Convert yards to feet.</p> <p>5.7 yards</p>
<p>e. Convert kilograms to grams.</p> <p>6.08 kg</p>	<p>f. Convert pounds to ounces.</p> <p>12.5 pounds</p>

2. After solving, write a statement to express each conversion. The first one is done for you.

<p>a. Convert the number of hours in a day to minutes.</p> $\begin{aligned}24 \text{ hours} &= 24 \times (1 \text{ hour}) \\ &= 24 \times (60 \text{ minutes}) \\ &= 1,440 \text{ minutes}\end{aligned}$ <p>One day has 24 hours, which is the same as 1,440 minutes.</p>	<p>b. A small female gorilla weighs 68 kilograms. How much does she weigh in grams?</p>
<p>c. The height of a man is 1.7 meters. What is his height in centimeters?</p>	<p>d. The capacity of a syringe is 0.08 liters. Convert this to milliliters.</p>
<p>e. A coyote weighs 11.3 pounds. Convert the coyote's weight to ounces.</p>	<p>f. An alligator is 2.3 yards long. What is the length of the alligator in inches?</p>

Name _____

Date _____

Solve.

- a. Convert pounds to ounces.
(1 pound = 16 ounces)

$$\begin{aligned} 14 \text{ pounds} &= \underline{\hspace{2cm}} \times (1 \text{ pound}) \\ &= \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} \text{ ounces}) \\ &= \underline{\hspace{2cm}} \text{ ounces} \end{aligned}$$

- b. Convert kilograms to grams.

$$\begin{aligned} 18.2 \text{ kilograms} &= \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}}) \\ &= \underline{\hspace{2cm}} \times (\underline{\hspace{2cm}}) \\ &= \underline{\hspace{2cm}} \text{ grams} \end{aligned}$$

Name _____

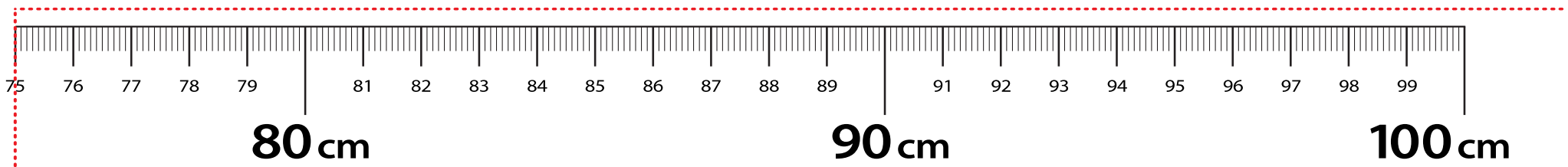
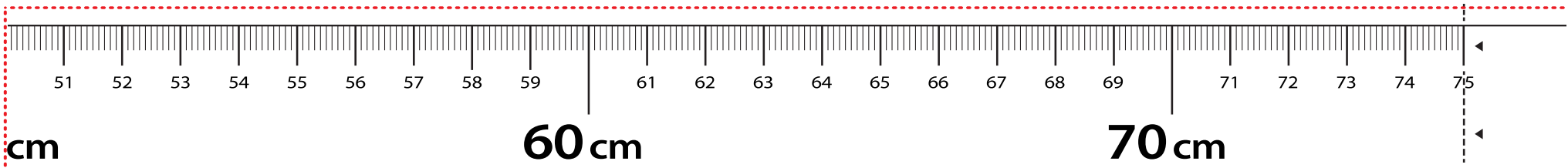
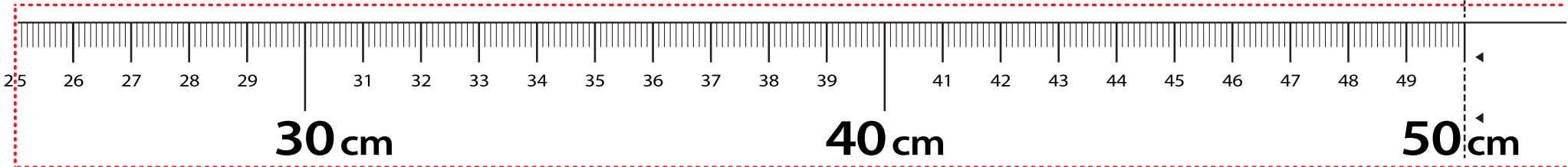
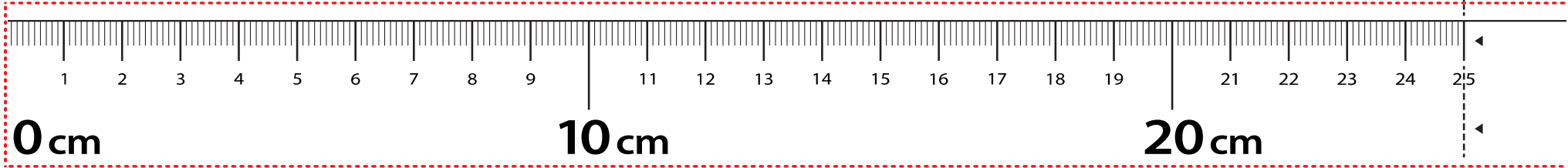
Date _____

1. Solve. The first one is done for you.

<p>a. Convert weeks to days.</p> <p>6 weeks = $6 \times (1 \text{ week})$</p> <p>= $6 \times (7 \text{ days})$</p> <p>= 42 days</p>	<p>b. Convert years to days.</p> <p>7 years = _____ \times (_____ year)</p> <p>= _____ \times (_____ days)</p> <p>= _____ days</p>
<p>c. Convert meters to centimeters.</p> <p>4.5 m = _____ \times (_____ m)</p> <p>= _____ \times (_____ cm)</p> <p>= _____ cm</p>	<p>d. Convert pounds to ounces.</p> <p>12.6 pounds</p>
<p>e. Convert kilograms to grams.</p> <p>3.09 kg</p>	<p>f. Convert yards to inches.</p> <p>245 yd</p>

2. After solving, write a statement to express each conversion. The first one is done for you.

<p>a. Convert the number of hours in a day to minutes.</p> $\begin{aligned}24 \text{ hours} &= 24 \times (1 \text{ hour}) \\ &= 24 \times (60 \text{ minutes}) \\ &= 1,440 \text{ minutes}\end{aligned}$ <p>One day has 24 hours, which is the same as 1,440 minutes.</p>	<p>b. A newborn giraffe weighs about 65 kilograms. How much does it weigh in grams?</p>
<p>c. The average height of a female giraffe is 4.6 meters. What is her height in centimeters?</p>	<p>d. The capacity of a beaker is 0.1 liter. Convert this to milliliters.</p>
<p>e. A pig weighs 9.8 pounds. Convert the pig's weight to ounces.</p>	<p>f. A marker is 0.13 meters long. What is the length in millimeters?</p>



LEGEND - - - - CUT - - - - ALIGN EDGE

meter strip