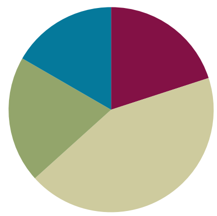
Lesson 13

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 × 0.1 = ____.) Say the answer.

S: 3.

Repeat the process for the following possible sequences: 300 × 0.01; 3,000 × 0.001; 5,000 × 0.001; 50 × 0.1; 500 × 0.01; 5,000 × 0.01; 3,000 × 0.01; 30,000 × 0.001; 50,000 × 0.001; 40 × 0.1, 400 × 0.1; 4,000 × 0.1; 40,000 × 0.1; 700 × 0.01; 7,000 × 0.01; 70,000 × 0.01; 700,000 × 0.01; 7,000,000 × 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 ft = ____ 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 cm = ____ 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:

	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

- Although the number of units has changed, the length of the string is the same.
- 1.05 meters × 10^{3} = 1,050 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.

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 = ____ days

3 weeks = 3 × (1 week)

= 3 × (7 days)

= 21 days

T: (Write 3 weeks = 3 × (1 week) on the board.) Explain to your partner why this is true.

S: 3 weeks is the same as 3 units of 1 week. → It's 3 groups of 1 week. → 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 × (7 days) directly below 3 × (1 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: (After 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?

> 3 hours = ____ minutes
>
> 3 hours = 3 × (1 hour)
>
> = 3 × (60 minutes)
>
> = 180 minutes

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. → The number of units increased, but the time stayed the same.

Problem 2

1.05 m = ____ cm

1.05 m = 1.05 × (1 m)

= 1.05 × (100 cm)

= 105 cm

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. → 1.05 × 1 meter.

T: (Write 1.05 m = 1.05 × (1 m).) Let's rename the conversion factor in centimeters. 1 meter equals…?

S: 100 centimeters.

T: (Write 1.05 m = 1.05 × (100 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.

0.09 m = ____ cm	0.09 m = ____ mm
0.09 m = 0.09 × (1 m)	0.09 m = 0.09 × (1 m)
= 0.09 × (100 cm)	= 0.09 × (1,000 mm)
= 9 cm	= 90 mm

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 the students. Write the measurement as an equivalent expression with the unit as a factor.

5.7 kg = ____ g	56.75 lb = ____ oz
5.7 kg = 5.7 × (1 kg)	56.75 lb = 56.75 × (1 lb)
= 5.7 × (1,000 g)	= 56.75 × (16 oz)
= 5,700 g	= 908 oz

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.

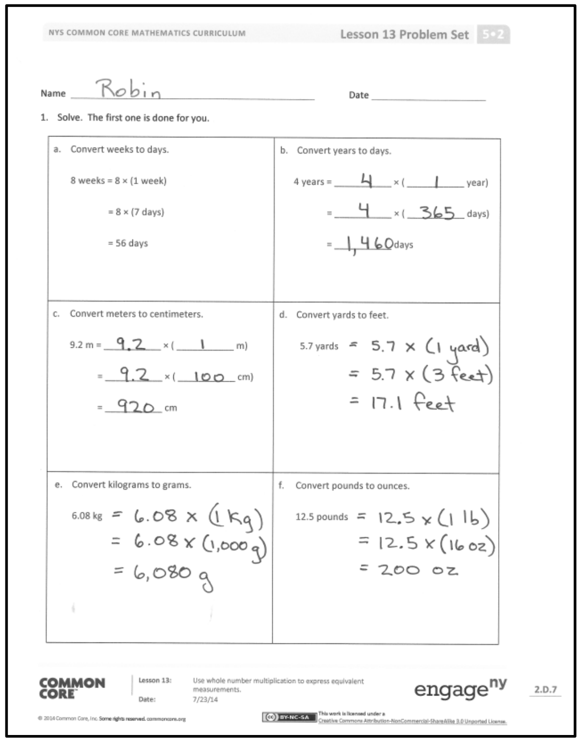
Student Debrief (10 minutes)

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. You may choose to use any combination of the questions below 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 × (1 in) = 14 × ($\frac{1}{12}$ 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?


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

COMMON CORE Lesson 13: Use whole number multiplication to express equivalent measurements. Date: 7/23/14 engage^ny 2.D.7
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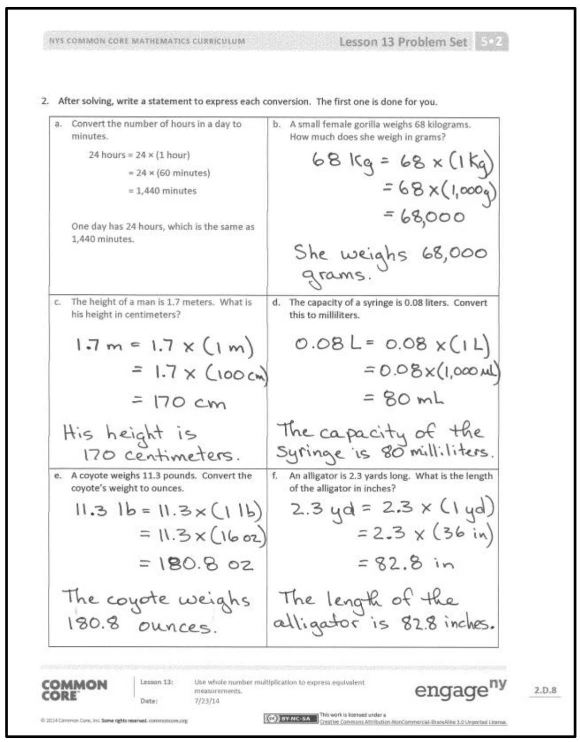
NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 13 Problem Set 5•2

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 × (1 hour) = 24 × (60 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 kg = 68 × (1 kg) = 68 × (1,000 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 m = 1.7 × (1 m) = 1.7 × (100 cm) = 170 cm His height is 170 centimeters.	d. The capacity of a syringe is 0.08 liters. Convert this to milliliters. 0.08 L = 0.08 × (1 L) = 0.08 × (1,000 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 lb = 11.3 × (1 lb) = 11.3 × (16 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 yd = 2.3 × (1 yd) = 2.3 × (36 in) = 82.8 in The length of the alligator is 82.8 inches.

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Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name ____ Date ____________________

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

a. Convert weeks to days. 8 weeks = 8 × (1 week) = 8 × (7 days) = 56 days	b. Convert years to days. 4 years = __________ × (__________ year) = __________ × (__________ days) = __________ days
c. Convert meters to centimeters. 9.2 m = __________ × (__________ m) = __________ × (__________ cm) = __________ cm	d. Convert yards to feet. 5.7 yards
e. Convert kilograms to grams. 6.08 kg	f. Convert pounds to ounces. 12.5 pounds

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 × (1 hour) = 24 × (60 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?
c. The height of a man is 1.7 meters. What is his height in centimeters?	d. The capacity of a syringe is 0.08 liters. Convert this to milliliters.
e. A coyote weighs 11.3 pounds. Convert the coyote's weight to ounces.	f. An alligator is 2.3 yards long. What is the length of the alligator in inches?

Name ____ Date ____________________

1. Solve.

a. Convert pounds to ounces. (1 pound = 16 ounces) 14 pounds = ________ × (1 pound) = ________ × (________ ounces) = ________ ounces	b. Convert kilograms to grams. 18.2 kilograms = ________ × (________) = ________ × (________) = ________ grams

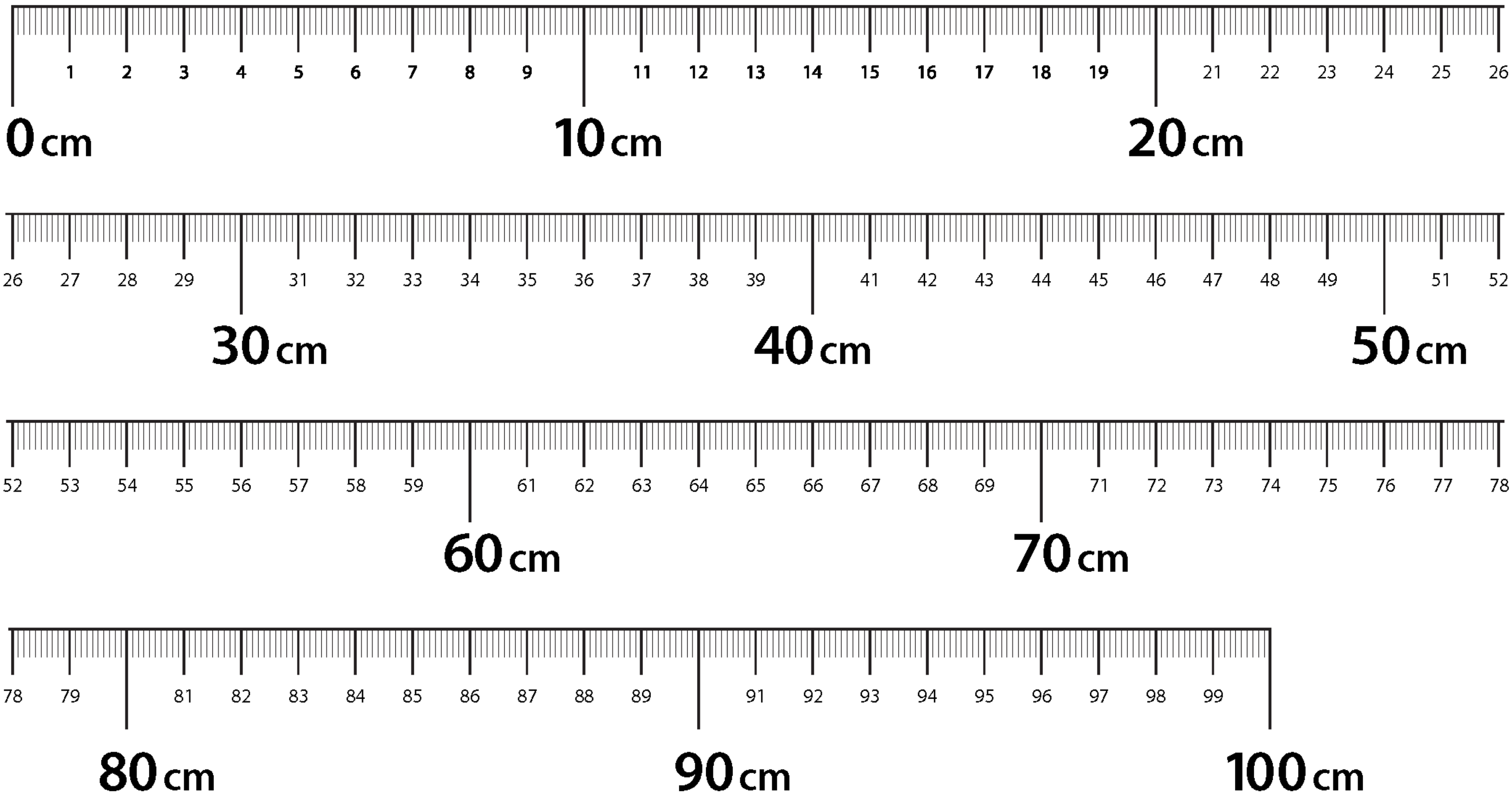
Name ______________________________ Date ________________

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

a. Convert weeks to days. 6 weeks = 6 × (1 week) = 6 × (7 days) = 42 days	b. Convert years to days. 7 years = ________ × (________ year) = ________ × (________ days) = ________ days
c. Convert meters to centimeters. 4.5 m = ________ × (________ m) = ________ × (________ cm) = ________ cm	d. Convert pounds to ounces. 12.6 pounds
e. Convert kilograms to grams. 3.09 kg	f. Convert yards to inches. 245 yd

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


1 2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 19 21 22 23 24 25 26
0 cm
10 cm
20 cm
26 27 28 29 31 32 33 34 35 36 37 38 39 41 42 43 44 45 46 47 48 49 51 52
30 cm
40 cm
50 cm
52 53 54 55 56 57 58 59 61 62 63 64 65 66 67 68 69 71 72 73 74 75 76 77 78
60 cm
70 cm
78 79 81 82 83 84 85 86 87 88 89 91 92 93 94 95 96 97 98 99
80 cm
90 cm
100 cm

meter strip