

# Patterns in Base Ten

## A Fifth Grade Learning Focused Unit



**Family Foundations Academy**

**Copy this page as needed for additional lessons.**

**Decision 6: Acquisition Lesson #1**

(Lesson plan necessary for student learning. You will have multiple Acquisition Lessons within a unit.  
Not all parts need to be filled in; use only those applicable.)

**Unit Topic:** Numbers in Base Ten

**Standards:**

**5.NBT.1** Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and  $\frac{1}{10}$  of what it represents in the place to its left.

**5.NBT.2** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

**5.MD.1** Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

Coherence -Links from: G4–M1 Place Value, Rounding, and Algorithms for Addition and Subtraction

-Links to: G6–M2 Arithmetic Operations Including Dividing by a Fraction

**STANDARDS FOR MATHEMATICAL PRACTICE**

SMP1 Make sense of problems and persevere in solving them.

SMP 2. Reason abstractly and quantitatively.

SMP 3. Construct viable arguments and critique the reasoning of others.

SMP4 Model with mathematics

SMP 5. Use appropriate tools strategically.

SMP 6. Attend to precision.

SMP 7. Look for and make use of structure.

SMP 8. Look for and express regularity in repeated reasoning.

Lesson Essential Question	How can you describe the relationship between two place value positions? How does multiplying a whole number by a power of ten affect the product?
Time (In Days)	2
Activating Thinking (Hook to motivate, link to prior knowledge)	<a href="https://learnzillion.com/lessons/2488-multiply-by-multiples-of-10-with-base-ten-blocks">https://learnzillion.com/lessons/2488-multiply-by-multiples-of-10-with-base-ten-blocks</a> The teacher will play the above video modeling multiples of ten with base ten blocks. Using iTools the teacher will model tens to 100. The teacher will record the numbers on the board. Students will be asked to explain how they recognized multiples of 10. Students will then perform a "sprint" which will focus on multiplying by 10.
Accele	

ration/  
Previewing  
(Preview of key vocabulary, concepts, and skills prior to learning)

Period, multiples.

Teaching Activities and Strategies  
(Examples: Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)

1. Rename the Units. Students will be given ones and will have to convert them to tens. Examples will include 10, 20, 30, 50, 230, 470, 560, 640, 890, 910-DOK 1

Number	Groups of Tens
10	1
20	2
30	3
50	5
230	23
470	47
560	56
640	64
890	89
910	91

Key Questions: Add throughout the lesson

2. The teacher will review with students the values of each type of base ten block and the relationship from one type to the next. Teacher will teach that each base ten block is one tenth of the base ten block to its left.
3. Students will be given place value charts to use to find numbers that are ten times as much or one tenth as much of the original numbers. How can we show 1 million using hundred thousands?-DOK 2
4. Work with your partner to show this on your chart. Students will work with partners to divide each place by ten. Students will complete the sequence until they reach the hundredth place. Students will be asked to determine the patterns they notice. DOK 2
5. Students will work in small groups to jigsaw and answer two of the below questions. They will then jigsaw again and share out their solutions. They will compare and contrast their solutions with the new members of the groups. DOK 2  
**2CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.**

Compare the solutions you found when : DOK 2

1. multiplying by 10 and dividing by 10 ( $3.452 \cdot 10$  and  $345 \div 10$ ).
2. How do the solutions of these two expressions relate to the value of the original quantity? How do they relate to each other? DOK 2
3. What do you notice about the number of zeros in your products when multiplying by 10, 100, and 1,000 relative to the number of places the digits shift on the place value chart? What patterns do you notice? DOK1

**Students will work in small jigsaw groups to solve the below word problems.**

Students will then jigsaw again and explain their problem to another small group. Students will perform error analysis to determine the correct answer.

**CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.**

4. . A manufacturer made 7,234 boxes of coffee stirrers. Each box contains 1,000 stirrers. How many stirrers did they make? Explain your thinking, and include a statement of the solution. **DOK 2**

5. . A student used his place value chart to show a number. After the teacher instructed him to multiply his number by 10, the chart showed 3,200.4. Draw a picture of what the place value chart looked like at first.. Explain how you decided what to draw on your place value chart. Be sure to include your reasoning about how the value of each digit was affected by the multiplication. Use words, pictures, or numbers.  
**CCSS.MATH.PRACTICE.MP4 Model with mathematics.DOK2**

6. A microscope has a setting that magnifies an object so that it appears 100 times as large when viewed through the eyepiece. If a tiny insect is 0.095 cm long, how long will the insect appear in centimeters through the microscope? Explain how you know. **DOK 2**

7. **Students will work in collaborative pairs to solve the following problems: DOK1**

a.  $6.671 \times 100 =$  \_\_\_\_\_

b.  $684 \div 1,000 =$  \_\_\_\_\_

c.  $7.281 \times 100 =$  \_\_\_\_\_

d.  $9.254 \times 1,000 =$  \_\_\_\_\_

e. Explain how and why the value of the 2 changed in (a), (b), and (c). **DOK2**

f.  $678 \div 100 =$  \_\_\_\_\_

g.  $67 \div 1,000 =$  \_\_\_\_\_

h. Explain how and why the value of the 6 changed in the quotients in f and g. **DOK 2**

Summarizing Strategies (Learners summarize and answer LEQ)

**Exit Ticket:** How can you describe the relationship between the million and the hundred thousand position? Students will write a letter to an absent student and explain. The teacher will analyze the responses to determine understanding. Those students who do not demonstrate a solid understanding will be given small group instruction the next day and will use the remediation tools listed with the teacher. **DOK 2**

Extending/Refining

Students will be asked to write a number that has four digits with the same number in all the

Activities	places, such as 4,444. Students will circle the digit with the greatest value and underline the digit with the smallest value. They will then explain their choices. <b>DOK 2</b>
Assignment Higher Order Thinking Questions	<p>Farmer Jim keeps 12 hens in every coop. If Farmer Jim has 20 coops, how many hens does he have in all? If every hen lays 9 eggs on Monday, how many eggs will Farmer Jim collect on Monday? Explain your reasoning using words, numbers, or Pictures. <b>DOK 2 CCSS.MATH.PRACTICE.MP4 Model with mathematics.</b></p> <p><b>Constructing Task: **Patterns R Us CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.</b></p> <p>In this task, students are asked to identify, describe, and explain any patterns they notice when multiplying numbers by powers of 10 such as 1,000, 100 and 10.</p> <p><b>TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION:</b></p> <p><b>TASK</b></p> <p>Students will follow the directions below from the “Patterns-R-Us” Recording Sheet.</p> <p>A statistician is interested in finding out what pattern is created, if any, under certain situations. Your mission is to help come up with concrete rules for certain mathematical situations. Record all of your work and explain your thinking in order to defend your answer. Good luck!</p> <p><b>PART ONE DOK 2</b></p> <ol style="list-style-type: none"> <li>1. Start with 4.</li> <li>2. Multiply that number by 1000, 100, and 10.</li> <li>3. What is happening?</li> <li>4. Is there a pattern?</li> <li>5. What do you think would happen if you multiplied your number by 1,000,000?</li> </ol> <p><b>PART TWO DOK 2</b></p> <ol style="list-style-type: none"> <li>1. Start with 23.</li> <li>2. Multiply that number by 1000, 100, and 10.</li> <li>3. What is happening?</li> <li>4. Is there a pattern?</li> <li>5. What do you think would happen if you multiplied your number by 1,000,000?</li> </ol> <p><b>PART THREE DOK 2</b></p> <ol style="list-style-type: none"> <li>1. Start with any whole number.</li> <li>2. Multiply that number by 1000, 100, and 10.</li> <li>3. What is happening?</li> <li>4. Is there a pattern?</li> </ol>

5. What do you think would happen if you multiplied your number by 1,000,000?

**PART FOUR DOK 3**

1.  $28 \times 10^2 = 2,800$
2.  $28 \times 10^3 = 28,000$
3. What is the product of  $28 \times 10^4$ ?
4. Is there a pattern?
5. Is there a similar pattern you've noticed?
  - **Justify** why your answer is correct.
  - What would happen if you started with a different number?
  - What patterns are you noticing?
  - Can you predict what would come next in the pattern? Explain your prediction.

**Patterns-R-Us DOK 3**

A statistician is interested in finding out what pattern is created, if any, under certain situations. Your mission is to help come up with **concrete rules for certain mathematical situations and operations**. Record all of your work and explain your thinking so that you can defend your answers.

Multiply

4

X 1,000

X 100

X 10

What is happening? \_\_\_\_\_

\_\_\_\_\_

Is there a pattern? \_\_\_\_\_

\_\_\_\_\_

What do you think would happen if you multiplied your number by 1,000,000?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Multiply 23

X 1,000

X 100

X 10

What is happening? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Is there a pattern? \_\_\_\_\_

\_\_\_\_\_

What do you think would happen if you multiplied your number by 1,000,000?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Pick a whole number to multiply

X 10

X 100

X 1,000

What is happening? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Is there a pattern? \_\_\_\_\_

\_\_\_\_\_

What do you think would happen if you multiplied your number by 1,000,000?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Complete the pattern      28

X  $10^2$  2,800

X  $10^3$  28,000

X  $10^4$

Is there a pattern? \_\_\_\_\_

\_\_\_\_\_

Is there a similar pattern you've noticed?

\_\_\_\_\_  
\_\_\_\_\_

Looking at the patterns you have identified, what **conjecture** can you make about multiplying numbers by powers of 10?

\_\_\_\_\_  
\_\_\_\_\_

	<p>_____</p> <p>How does the use of exponents in <math>10^2</math> and <math>10^3</math> connect to changes in the place value of numbers?</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Re-Teaching Focus &amp; Strategy</p>	<p>Place Value Chart will be used as needed as well as the recording sheet for Patterns are Us. <a href="http://www.homeschoolmath.net/teaching/d/multiply_divide_by_10_100_1000.php">http://www.homeschoolmath.net/teaching/d/multiply_divide_by_10_100_1000.php</a></p>
<p>Differentiation</p>	<p>The Resource below will be used to differentiate for those students who are struggling with place value. The teacher will create observations based off of the Patterns R Us activity. Based off the observations made the following adjustments will be made to the lesson plan: <b>DIFFERENTIATION</b> <b>Extension</b></p> <ul style="list-style-type: none"> <li>• Have students extend the pattern of exponents to include <math>10^5</math> and <math>10^6</math>. What numbers will be represented?</li> </ul> <p><b>Intervention</b></p> <ul style="list-style-type: none"> <li>• Pair students who may need additional time together so that they will have time needed to process this task.</li> <li>• Students may need to use a 10 x 10 grid to relate back to <math>10^2</math> as having an area of 100 sq. units.</li> </ul>
<p>Review &amp; Revise (Teacher Reflection)</p>	<p><a href="https://www.nsa.gov/academia/files/collected_learning/elementary/arithmetric/exploring_place_and_space.pdf">https://www.nsa.gov/academia/files/collected_learning/elementary/arithmetric/exploring_place_and_space.pdf</a> <a href="http://maccss.ncdpi.wikispaces.net/file/view/CCSSMathTasks-Grade5.pdf">http://maccss.ncdpi.wikispaces.net/file/view/CCSSMathTasks-Grade5.pdf</a></p>
<p>Resources &amp; Materials</p>	<p>Base Ten Blocks, Website</p>

**Decision 6: Acquisition Lesson #2**

(Lesson plan necessary for student learning. You will have multiple Acquisition Lessons within a unit.



Not all parts need to be filled in; use only those applicable.)

**Unit Topic:** Place Values

**Standards:**

Skip-Counting 3.OA.4–6

Take Out the Tens 2.NBT.1

Bundle Ten and Change Units 4.NBT.1

Multiply and Divide by 10 5.NBT.1

Math Practices: **CCSS.MATH.PRACTICE.MP8 Look for and express regularity in repeated reasoning.** **CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.**

**CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others**

Lesson Essential Question	How do you read, write, and represent whole numbers through hundred thousands?
Time (In Days)	2
Activating Thinking (Hook to motivate, link to prior knowledge)	<p>The teacher will introduce the lesson by discussing the sun's size and it's location in our solar system. Explain that the distances between the sun and the planets are very large numbers.</p> <p>Practicing <b>skip-counting</b> on the number line builds a foundation for accessing higher order concepts throughout the year. Direct students to count forward and backward by threes to 36, emphasizing the transitions of crossing the ten. Direct students to count forward and backward by fours to 48, emphasizing the transitions of crossing the ten.</p> <p><b>DOK 1</b></p> <p><b>Take Out the Tens (2 minutes) DOK 1</b> Materials: Personal white board Note: Decomposing whole numbers into different units lays a foundation to do the same with decimal fractions. T: (Write 83 ones = ____ tens ____ ones.) Write the number sentence. S: (Write 83 ones = 8 tens 3 ones.) Repeat the process for 93 ones, 103 ones, 113 ones, 163 ones, 263 ones, 463 ones, and 875 ones.</p>
Acceleration/Previewing (Preview of key vocabulary, concepts, and skills prior to learning)	Period, skip counting
Teaching Activities and Strategies (Examples: Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)  Key Questions: Add throughout the lesson	<p>A school district ordered 247 boxes of pencils. Each box contains 100 pencils. If the pencils are to be shared evenly among 10 classrooms, how many pencils will each class receive? Draw a place value chart to show your thinking. If each student received about 100 pencils estimate how many students would be in each classroom? Explain your thinking and the strategy you used to find the answer. List the steps you took to solve it in sequential order. <b>DOK 3</b></p>

**Problem 1 DOK 2- CCSS.MATH.PRACTICE.MP7 Look for and make use of structure. CCSS.MATH.PRACTICE.MP8 Look for and express regularity in repeated reasoning.**

$$367 \times 10$$

$$367 \div 10$$

$$4,367 \times 10$$

$$4,367 \div 10$$

T: Work with your partner to solve these problems.

Write two complete number sentences on your board.

Students will be asked to explain how they got their answer and will be asked to demonstrate patterns that they notice.

What patterns do you notice in the number of zeros in the product and the placement of the decimal in the quotient?

What do you notice about the number of zeros in your factors and the shift in places in your product? What do you notice about the number of zeros in your divisor and the shift in places in your quotient?

Problem 2:

$$215.6 \times 100$$

$$215.6 \div 100$$

$$3.7 \times 100$$

$$3.7 \div 100$$

T: Now, solve with your partner by visualizing your place value chart and recording only your products and quotients. Students can use the place value chart as needed. Compare your work with your partner's. Do you agree? (**CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others**). How many times did the digits shift in each problem, and why? Share your thinking with your partner. **DOK 2**

Problem 3

$$0.482 \times 1,000$$

$$482 \div 1,000$$

Follow a similar sequence for these expressions.

**Summarizing Strategies**  
(Learners summarize and answer LEQ)

a.  $32.1 \times 10 =$  \_\_\_\_\_ b.  $3632.1 \div 10 =$  \_\_\_\_\_

a.  $455 \times 1,000 =$  \_\_\_\_\_ b.  $455 \div 1.000 =$  \_\_\_\_\_

**DOK 1**

**Extending/Refining Activities**

**DOK 2**

Janice thinks that 20 hundredths is equivalent to 2 thousandths because 20 hundreds is equal to 2 thousands. Use words and a place value chart to correct Janice's error.

Ted says that 3 tenths multiplied by 100 equals 300 thousandths. Is he correct? Use a place value chart to explain your answer.

**High Roller Revisited – DOK 1**

Directions:

- The object of each round is to use 4 digits to create the greatest number

possible.

- Each player takes a turn rolling the die and deciding where to record the digit on their place value chart.
- Players continue taking 3 more turns so that each player has written 4 digits.
- Once a digit is recorded, it cannot be changed.
- Compare numbers. The player with the greatest number wins the round.
- Play 5 rounds.

[https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS\\_Math\\_5\\_Unit2Framework.pdf](https://www.georgiastandards.org/Common-Core/Common%20Core%20Frameworks/CCGPS_Math_5_Unit2Framework.pdf)

**Assignment and/or Assessment**

**Problem Set: Students will track their data about completion and accuracy rates. Students will set personal goals to improve both their completion and accuracy rates. DOK 1**

- $54,000 \times 10 =$  \_\_\_\_\_
- $54,000 \div 10 =$  \_\_\_\_\_
- $8.7 \times 10 =$  \_\_\_\_\_
- $8.7 \div 10 =$  \_\_\_\_\_
- $0.13 \times 100 =$  \_\_\_\_\_
- $13 \div 1,000 =$  \_\_\_\_\_
- $3.12 \times 1,000 =$  \_\_\_\_\_
- $4,031.2 \div 100 =$  \_\_\_\_\_

**2. Find the products.**

- $19,340 \times 10 =$  \_\_\_\_\_
- $19,340 \times 100 =$  \_\_\_\_\_
- $19,340 \times 1,000 =$  \_\_\_\_\_

d. Explain how you decided on the number of zeroes in the products for (a), (b), and (c). **DOK 2**

**3. Find the quotients.**

- $152 \div 10 =$  \_\_\_\_\_
- $152 \div 100 =$  \_\_\_\_\_
- $152 \div 1,000 =$  \_\_\_\_\_

d. Explain how you decided where to place the decimal in the quotients for (a), (b), and (c). **DOK 2**

Re-Teaching Focus & Strategy	<a href="http://www.greatmathsteachingideas.com/wp-content/uploads/2012/02/Multiplying-and-dividing-by-10-100-and-1000.pdf">http://www.greatmathsteachingideas.com/wp-content/uploads/2012/02/Multiplying-and-dividing-by-10-100-and-1000.pdf</a>
Differentiation	Teacher will work with students in small groups who need remediation multiplying whole numbers by 10,100, and 1,000 will use the resource found above. The students who demonstrate difficulty multiplying and dividing by decimals will use the Decimal Numbers resource. Students who need their learning extended will use the Powers of 10 Flap Book.
Review and Revise:	<b>Math Success: Decimal numbers</b> - Multiplication and division by 10, 100, 1000, 0.1, 0.01, 0.001 Students will use the Math Success App to review the material during the Enrichment and RTI time. <b>Powers of 10 Flap Books</b> – used to investigate what happens when a number is either multiplied or divided by 10 again and again.
Materials	iPad, Module, PDF

### Decision 6: Acquisition Lesson #3

(Lesson plan necessary for student learning. You will have multiple Acquisition Lessons within a unit. Not all parts need to be filled in; use only those applicable.)

**Unit Topic:** Use exponents to name place value units, and explain patterns in the placement of the decimal point.

#### Standards:

**Multiply by 3 3.OA.7**

**State the Unit as a Decimal—Choral Response 5.NBT.2**

**Multiply and Divide by 10, 100, and 1000 5.NBT.2**

**Standards for Mathematical Practice:**

**2. Reason abstractly and quantitatively**

**3. Construct viable arguments and critique the reasoning of others**

**4. Model with mathematics**

**7. Look for and make use of structure**

**8. Look for and express regularity in repeated reasoning.**

Lesson Essential Question	How do you use properties of operations to solve problems?
Time (In Days)	2 Days
Activating Thinking (Hook to motivate, link to prior knowledge)	▶▶

<https://www.khanacademy.org/...expon..>

Exponents;  
power; base Word Map Graphic Organizer  
Multiply by three sprint.

### **Building Powers of Ten**

<http://maccss.ncdpi.wikispaces.net/file/view/CCSSMathTasks-Grade5.pdf>

**Directions: DOK 2 CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.**

1. "How could you represent  $10 \times 10$ ?" Allow many student suggestions. If no one suggests a base-ten block, ask how these blocks could be used to show  $10 \times 10$

2. Show students the flat base-ten block (sometimes called a "hundreds block"). "What shape is this block?" "Why does it make sense that it is a square?"

3. Distribute base-ten blocks to each student. Have the students use their blocks to prove that  $10 \times 10 = 100$  and that this array forms a square. Students make need to share materials and work together.

4. On the board write the following:  $10 \times 10 = 10^2$

Tell students that  $10^2$  is read "ten squared." Ask the class to explain how it might have gotten that name (the array for  $10 \times 10$  is a square).

5. Distribute the Powers of Ten chart to each student. Point out that they have just worked on the first row.

6. Ask students to use their blocks to build  $10 \times 10 \times 10$ . Have students share their strategies.

Did they recognize that this could be rewritten as  $10 \times 100$  and could be built as ten hundreds blocks stacked into a cube?

7. On the board write the following:  $10 \times 10 \times 10 = 10^3$

Tell the class that  $10^3$  is read "ten cubed." Ask the class to explain how it might have gotten that name (the base-ten blocks form a cube of 10 flats).

8. Continue the chart by working with  $10^1$

. Allow students to debate with one another how this might be written and built. Help the students make connections between the number of tens being multiplied and the number used in the exponent.

$10 \times 10$  multiplies two tens, so the exponent is a 2

$10 \times 10 \times 10$  multiplies three tens so the exponent is a 3

$10^1$  has an exponent of one, so it must have only one 10

9. Explain to the students that  $10^1$  tell us that we are working with one ten. On the board write the following:  $10 = 10^1$

Students can use a tens block (rod) to show  $10^1$

10. Challenge students to try the next row in their chart with a neighbor. Allow the students ample time to struggle with the work. As you circulate, listen to see if students are making connections to the exponents that they have already explored.

11. When most have finished invite students to share their thinking about  $10^4$

	<p>. The students are likely to have a variety of answers. Engage a lively debate by asking students to <b>justify their thinking and explain their reasoning</b>. Students may question one another. They may use blocks, observations, patterns, and logic to prove their answer. <b>DOK 3 CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving CCSS.MATH.PRACTICE.MP7 Look for and make use of structure. them.</b></p> <p><b>CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others.</b></p> <p><b>CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.</b></p> <p>CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.</p> <p>12. At a reasonable stopping point, help students see that <math>10^4</math> is written as <math>10 \times 10 \times 10 \times 10</math>. The teacher will explain that a number to the fourth power is cubed.</p> <p>This might be written in words as “ten to the fourth power.” not</p> <p>Write on the board: <math>10 \times 10 \times 10 \times 10 = 10^4</math></p> <p>13. For the final row of the chart, have students work with their partner. Then engage the class in another discussion of reasoning.</p> <p>14. To summarize, ask students to complete the “I Discovered That...” section of the recording sheet. Ask students, “What pattern do you notice?” Students should see that each the number of zeroes is changing. Ask students to explain why this pattern makes sense. <b>DOK 2</b></p>
<p>Acceleration/Previewing (Preview of key vocabulary, concepts, and skills prior to learning)</p>	<p><b>“Find Someone who Can...”</b> – Teacher created 3x3 grid of numerical expressions without exponents. Students walk around the room and ask other students to solve one of their expressions. Time limit is 3-5 minutes. <b>DOK 1</b></p>
<p>Teaching Activities and Strategies (Examples: Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)</p> <p>Key Questions: Add throughout the lesson</p>	<p><b>DOK 1</b></p> <p><b>CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.</b></p> <p>Students will write the following decimals: 9 tenths, 10 tenths, 11 tenths, 12 tenths, 18 tenths, 28 tenths, and 58 tenths. Repeat the process for 9 hundredths, 10 hundredths, 20 hundredths, 60 hundredths, 65 hundredths, 87 hundredths, and 118 tenths</p> <p>Students will solve the following problems using place value charts:  <math>0.004 \times 100,</math>  <math>0.004 \times 1000,</math>  <math>1.004 \times 1000</math>  <math>, 1.024 \times 100,</math>  <math>1.324 \times 100,</math>  <math>1.324 \times 10,</math> and <math>1.324 \times 1000.</math></p> <p>Repeat the process for dividing by 10, 100, and 1000 for the following possible sequence: <math>4 \div 1,</math> <math>4.1 \div 10,</math> <math>4.1 \div 100,</math> <math>41 \div 1000,</math> and <math>123 \div 1000.</math></p>

				100	10
				$10 \times 10$	$10 \times 1$

: (Write  $10 \times \underline{\quad} = 10$  on the board.) On your personal board, fill in the unknown factor to complete this number sentence.

S:  $10 \times 1 = 10$ .

T: (Write  $10 \times \underline{\quad} = 100$  on the board.) Fill in the unknown factor to complete this number sentence.

S:  $10 \times 10 = 100$ .

T: This time, using only 10 as a factor, how could you multiply to get a product of 1,000? Write the multiplication sentence on your personal board.

S:  $10 \times 10 \times 10 = 1,000$ .

T: Work with your partner. What would the multiplication sentence be for 10,000 using only 10 as a factor? Write it on your personal board.

S: (Write.)

T: How many factors of 10 did we have to multiply to get to 1,000?

S: 3.

T: How many factors of 10 do we have to multiply to get 10,000?

S: 4.

T: Say the number sentence.

S:  $10 \times 10 \times 10 \times 10 = 10,000$ .

T: How many zeroes are in our product, 10,000?

S: 4 zeroes.

T: What patterns do you notice? Turn and share with your partner.

S: The number of zeroes is the same on both sides of the equation.

□ The number of zeroes in the product is the same as the total number of zeroes in the factors. I see three zeroes on the left side, and there are three zeroes on the right side for  $10 \times 10 \times 10 = 1,000$ . The 1 moves one place to the left every time we multiply by 10. It's like a place value chart. Each number is 10 times as much as the last one.

T: Using this pattern, how many factors of 10 do we have to multiply to get 1 million? Work with your partner to write the multiplication sentence.

S: (Write.)

T: How many factors of 10 did you use?

S: 6.

T: Why did we need 6 factors of 10?

S: 1 million has 6 zeroes.

T: (Write the term exponent on the board.) We can use an exponent to represent how many times we use 10 as a factor. We can write  $10 \times 10$  as  $10^2$ .

. (Add to the chart.) We say, "Ten to the second power." The 2 (point to exponent) is the exponent, and it tells us how many times to use 10 as a factor.

T: How do you express 1000 using exponents? Turn and share with

your partner.

S: We multiply  $10 \times 10 \times 10$ , which is three times, so the answer is  $10^3$

There are three zeroes in 1,000, so it's ten to the third power.

T: Working with your partner, complete the chart using the exponents to represent each value on the place value chart.

1,000,000	100,000	10,000	1,000	100	10
$(10 \times 10 \times 10) \times (10 \times 10 \times 10)$	$10 \times 10 (10 \times 10 \times 10)$	$10 \times (10 \times 10 \times 10)$	$(10 \times 10 \times 10)$	$10 \times 10$	$10 \times 1$
$10^6$	$10^5$	$10^4$	$10^3$	$10^2$	$10^1$

After reviewing the chart with the students, challenge them to multiply 10 one hundred times. As some start to write it out, others may write 10100, a googol, with exponents.

T: Now, look at the place value chart. Let's read our powers of 10 and the equivalent values.

S: Ten to the second power equals 100. Ten to the third power equals 1,000. (Continue to read chorally up to 1 million.)

T: A googol has 100 zeroes. Write it using an exponent on your personal board.

S: (Write  $10^{100}$ .)

### Problem 2

$10^5$

T: Write ten to the fifth power as a product of tens.

S:  $10^5$

$= 10 \times 10 \times 10 \times 10 \times 10$ .

T: Find the product.

S:  $10^5$

$= 100,000$ .

Repeat with more examples as needed.

### Problem 3

$10 \times 100$

T: Work with your partner to write this expression using an exponent on your personal board. Explain your reasoning.

S: I multiply  $10 \times 100$  to get 1,000, so the answer is ten to the third power. □ There are 3 factors of 10. □ There are three tens. I can see one 10 in the first factor and two more tens in the second factor.

Repeat with  $100 \times 1000$  and other examples as needed.

### Problem 4

$3 \times 10^2$

$3.4 \times 10^3$

T: Compare these expressions to the ones we've already talked about.

S: These have factors other than 10.

T: Write  $3 \times 10^2$  without using an exponent. Write it on your personal board.

S:  $3 \times 100$ .

T: What's the product?



S: 300.

T: If you know that  $3 \times 100$  equals 300, then what is  $3 \times 10^2$ ? Turn and explain to your partner.

S: The product is also 300.  $10^2$  and 100 are the same amount, so the product will be the same.

T: Use what you learned about multiplying decimals by 10, 100, and 1,000 and your new knowledge about exponents to solve  $3.4 \times 10^3$  with your partner.

S:  $3.4 \times 10^3 = 3,400$

Repeat with  $4.021 \times 10^2$  and other examples as needed.

Have students share their solutions and reasoning about multiplying decimal factors by powers of 10. In particular, students should articulate the relationship between the exponent, how the values of the digits change, and the placement of the decimal in the product.

### Problem 5

$700 \div 10^2$

$7.1 \div 10^2$

T: Write  $700 \div 10^2$  without using an exponent, and find the quotient. Write it on your personal board.

S:  $700 \div 100 = 7$ .

T: If you know that  $700 \div 100$  equals 7, then what is  $700 \div 10^2$ ?

Turn and explain to your partner.

The quotient is 7 because  $10^2 = 100$ .  $\square$  7 hundreds divided by 1 hundred equals 7.

T: Use what you know about dividing decimals by multiples of 10 and your new knowledge about exponents to solve  $7.1 \div 10^2$  with your partner.

S: (Work.)

T: Tell your partner what you notice about the relationship between the exponents and how the values of the digits change. Discuss how you decided where to place the decimal.

### Problem 6

Complete this pattern: 0.043 4.3 430 \_\_\_\_\_

T: (Write the pattern on the board.) Turn and talk with your partner about the pattern on the board.

How is the value of the 4 changing as we move to the next term in the sequence? Draw a place value chart to explain your ideas as you complete the pattern, and use an exponent to express the relationships.

S: The 4 shifted two places to the left. Each number is being multiplied by 100 to get the next one.

Each number is multiplied by 10 twice. Each number is multiplied by 100.

Repeat with 6,300,000; \_\_\_\_\_; 630; 6.3; \_\_\_\_\_ and other patterns as needed.

T: As you work on the Problem Set, be sure you are thinking about the patterns that we've discovered today.

<p>Summarizing Strategies (Learners summarize and answer LEQ)</p>	<p><b>Mix –N- Match:</b> Students are to evaluate an expression involving exponents. Students are to match up with the person whose problem has the same answer. Mix-n-Match cards are provided. Attach them to index cards. <b>DOK 1</b></p> <p><b>Summary Point Writing/EXIT TICKET - •:</b> If 2 to the fourth power could talk how would it tell you to solve it to find its value? <b>DOK 2</b></p>
<p>Extending/Refining Activities</p>	<p><b>Super 3's.</b> Students use order of operations to create problems with answers from 0 – 100 using four 3's. Start by giving the class one problem to solve. Ask a student to describe how they solved it. Next, give the students 5 minutes to solve as many as they can. Then, have the students work in pairs, and finally have pairs combine into groups of 4.</p> <p><b>Error Analysis- DOK 2</b></p> <p>2. Shaunnie and Marlon missed the lesson on exponents. Shaunnie incorrectly wrote <math>10^5 = 50</math> on her paper, and Marlon incorrectly wrote <math>2.5 \times 10^2 = 2.500</math> on his paper.</p> <p>a. What mistake has Shaunnie made? Explain using words, numbers, or pictures why her thinking is incorrect and what she needs to do to correct her answer.</p> <p>b. What mistake has Marlon made? Explain using words, numbers, or pictures why his thinking is incorrect and what he needs to do to correct his answer. <b>CCSS.MATH.PRACTICE.MP4 Model with mathematics.</b></p> <p>c. After a lesson on exponents, Tia went home and said to her mom, "I learned that <math>10^4</math> is the same as 40,000." She has made a mistake in her thinking. Use words, numbers, or a place value chart to help Tia correct her mistake.</p>
<p>Assignment</p>	<p><b>CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.</b></p> <p>Jack and Kevin are creating a mosaic for art class by using fragments of broken tiles. They want the mosaic to have 100 sections. If each section requires 31.5 tiles, how many tiles will they need to complete the mosaic? <b>DOK 1</b></p> <p><b>Explain your reasoning with a place value chart.</b></p> <p><b>1. Write the following in exponential form (e.g., <math>100 = 10^2</math>).</b></p> <p>a. <math>10,000 =</math> _____</p> <p>b. <math>1,000 =</math> _____</p> <p>c. <math>10 \times 10 =</math> _____</p> <p>d. <math>100 \times 100 =</math> _____</p> <p>e. <math>1,000,000 =</math> _____</p> <p>f. <math>1,000 \times 1,000 =</math> _____</p> <p><b>2. Write the following in standard form (e.g., <math>5 \times 10^2 = 500</math>).</b></p> <p>a. <math>9 \times 10^3 =</math> _____</p>

- b.  $39 \times 10^4 =$  \_\_\_\_\_  
 c.  $7,200 \div 10^2 =$  \_\_\_\_\_  
 d.  $7,200,000 \div 10^3 =$  \_\_\_\_\_  
 e.  $4.025 \times 10^3 =$  \_\_\_\_\_  
 f.  $40.25 \times 10^4 =$  \_\_\_\_\_  
 g.  $72.5 \div 10^2 =$  \_\_\_\_\_  
 h.  $7.2 \div 10^2 =$  \_\_\_\_\_

3. Think about the answers to Problem 2(a–d). Explain the pattern used to find an answer when you multiply or divide a whole number by a power of 10. **DOK 2**

4. Think about the answers to Problem 2(e–h). Explain the pattern used to place the decimal in the answer when you multiply or divide a decimal by a power of 10. **DOK 2**

. Complete the patterns. **DOK 1**

a. 0.03 0.3 \_\_\_\_\_ 30

b. 6,500,000 65,000 \_\_\_\_\_ 6.5 \_\_\_\_\_

c. \_\_\_\_\_ 9,430 \_\_\_\_\_ 94.3 9.43 \_\_\_\_\_

d. 999 9990 99,900 \_\_\_\_\_

e. \_\_\_\_\_ 7.5 750 75,000 \_\_\_\_\_

f. Explain how you found the unknown numbers in set (b). Be sure to include your reasoning about the number of zeroes in your numbers and how you placed the decimal. **DOK 2**

g. Explain how you found the unknown numbers in set (d). Be sure to include your reasoning about the number of zeroes in your numbers and how you placed the decimal. **DOK 2**

$2.5 \times 10^2 = 2.500$  on his paper.

1. Write the following in exponential form and as a multiplication sentence using only 10 as a factor (e.g.,  $100 = 10^2 = 10 \times 10$ ). **DOK 1**

a.  $1,000 =$  \_\_\_\_\_  $=$  \_\_\_\_\_

b.  $100 \times 100 =$  \_\_\_\_\_  $=$  \_\_\_\_\_

2. Write the following in standard form (e.g.,  $4 \times 10^2 = 400$ ).

a.  $3 \times 10^2 =$  \_\_\_\_\_

b.  $2.16 \times 10^4 =$  \_\_\_\_\_

c.  $800 \div 10^3 =$  \_\_\_\_\_

d.  $754.2 \div 10^2 =$  \_\_\_\_\_

**Higher Order Thinking Question**

Select all the responses that are true equalities:

$12,500 =$

a.)  $12.5 \times 10^2$

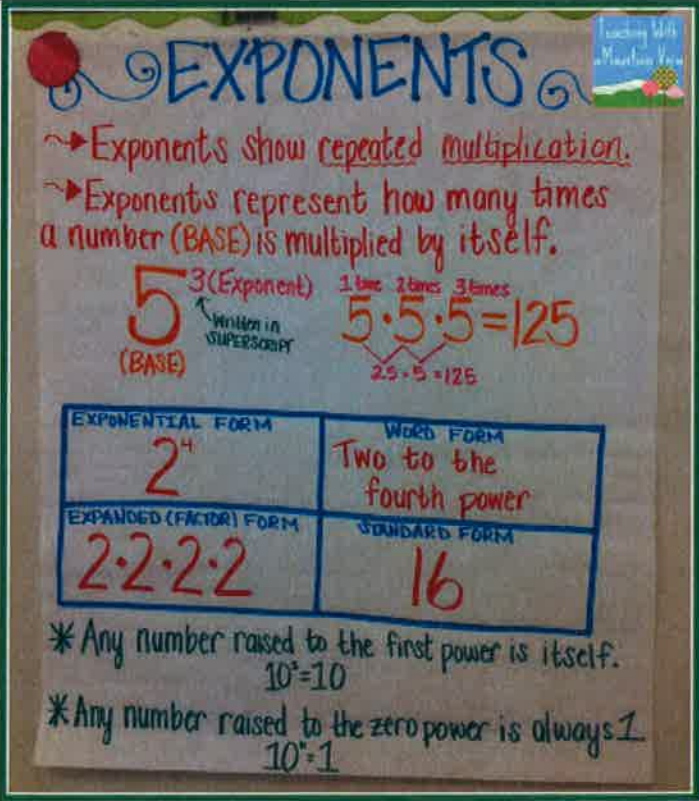
b.)  $12.5 \times 10^3$

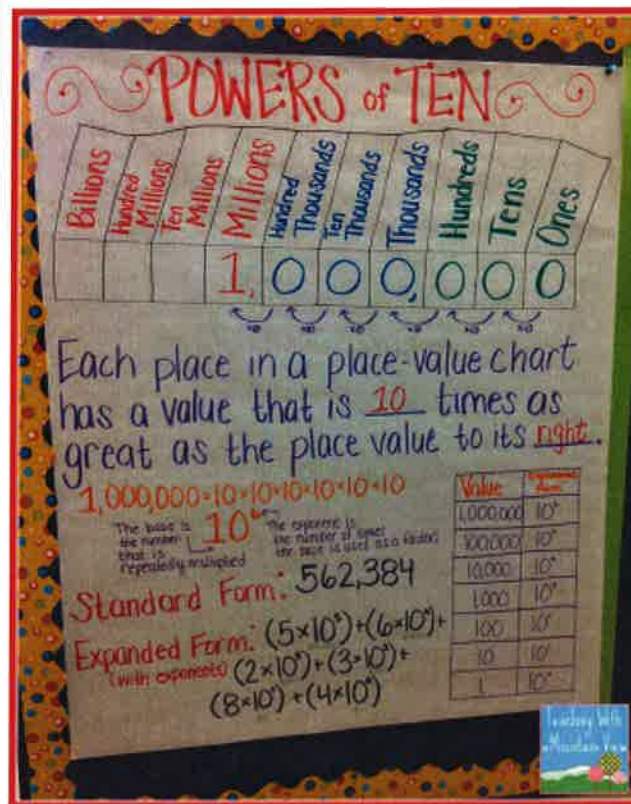
c.)  $1.25 \times 10^4$

d.)  $0.125 \times 10^5$

e.)  $0.125 \times 10^7$

List the steps in sequential order that you took to find the equalities.

	Justify your answers. <b>DOK 3</b>				
Re-Teaching Focus & Strategy	The teacher will reteach lessons using the resources listed below. The teacher will extend the lesson using magic square puzzles and exponents task cards. The teacher will use remediation videos and extra practice for those students struggling with exponents and radicals.				
Differentiation	Exponents Magic Square Puzzles <a href="https://www.teacherspayteachers.com/Login?f=/Product/FREE-Powers-of-Ten-Task-Cards-5NBT2-869477">https://www.teacherspayteachers.com/Login?f=/Product/FREE-Powers-of-Ten-Task-Cards-5NBT2-869477</a> Exponents Task Cards <a href="http://www.ixl.com/math/grade-5/evaluate-exponent-expressions">http://www.ixl.com/math/grade-5/evaluate-exponent-expressions</a>				
Review & Revise (Teacher Reflection)	Exponents Remediation Tutorial : <a href="https://www.youtube.com/watch?v=y09s6iQE5rQ">https://www.youtube.com/watch?v=y09s6iQE5rQ</a> <a href="http://www.math-play.com/exponent-game.html">http://www.math-play.com/exponent-game.html</a> <a href="https://www.youtube.com/watch?v=QIZTruxt2rQ">https://www.youtube.com/watch?v=QIZTruxt2rQ</a> <a href="http://www.mathexpression.com/exponent-laws.html">http://www.mathexpression.com/exponent-laws.html</a> <a href="http://www.math-aids.com/Radicals/">http://www.math-aids.com/Radicals/</a>				
Resources & Materials	 <p>The poster is titled "EXPONENTS" in large blue letters. It includes the following text and diagrams:</p> <ul style="list-style-type: none"> <li>Exponents show repeated multiplication.</li> <li>Exponents represent how many times a number (BASE) is multiplied by itself.</li> <li>An example shows the number 5 with a superscript 3. The 5 is labeled "(BASE)" and the 3 is labeled "3 (Exponent)". An arrow points to the 3 with the text "WRITTEN IN SUPERSCRIPT". To the right, the equation <math>5 \cdot 5 \cdot 5 = 125</math> is written, with "1 time", "2 times", and "3 times" above the 5s. Below the equation, a bracket indicates <math>25 \cdot 5 = 125</math>.</li> <li>A table with four quadrants: <table border="1" data-bbox="526 1461 1065 1688"> <tr> <td>EXPONENTIAL FORM <math>2^4</math></td> <td>WORD FORM Two to the fourth power</td> </tr> <tr> <td>EXPANDED (FACTOR) FORM <math>2 \cdot 2 \cdot 2 \cdot 2</math></td> <td>STANDARD FORM 16</td> </tr> </table> </li> <li>* Any number raised to the first power is itself. <math>10^1 = 10</math></li> <li>* Any number raised to the zero power is always 1. <math>10^0 = 1</math></li> </ul>	EXPONENTIAL FORM $2^4$	WORD FORM Two to the fourth power	EXPANDED (FACTOR) FORM $2 \cdot 2 \cdot 2 \cdot 2$	STANDARD FORM 16
EXPONENTIAL FORM $2^4$	WORD FORM Two to the fourth power				
EXPANDED (FACTOR) FORM $2 \cdot 2 \cdot 2 \cdot 2$	STANDARD FORM 16				



### Decision 6: Acquisition Lesson #4

(Lesson plan necessary for student learning. You will have multiple Acquisition Lessons within a unit. Not all parts need to be filled in; use only those applicable.)

**Unit Topic:** Unit Conversion

**Standards:** Multiply and Divide Decimals by 10, 100, and 1000 5.NBT.2  
 Write the Unit as a Decimal 5.NBT.1  
 Write in Exponential Form 5.NBT.2  
 Convert Units 4.MD.1

**Math Practice:** CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.

CCSS.MATH.PRACTICE.MP6 Attend to precision.

CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.

CCSS.MATH.PRACTICE.MP8 Look for and express regularity in repeated reasoning.

Lesson Essential Question	How can you use exponents to convert units of measurement?
Time (In Days)	2
Activating Thinking (Hook to motivate, link to prior knowledge)	Students will brainstorm a list of all the terms they know that relate to measurement and record their answers in list form on a chart and on separate index cards. Then, working with a partner students will label

(classify) the terms that the class has just brainstormed in order to make connections among the various categories of terms.  
 Finally, students will group terms that have common attributes.  
**DOK 2**  
<http://www.brainpop.com/math/numbersandoperations/metricvscustomary/preview.weml>

**Multiply and Divide Decimals by 10, 100, and 1000**  
 T: (Project place value chart from millions to thousandths. Draw 3 disks in the tens place, 2 disks in the ones place, and 4 disks in the tenths place.) Say the value as a decimal.  
 S: 32.4 (thirty-two and four tenths).  
 T: Write the number on your personal boards and multiply it by 10.  
 S: (Write 32.4 on their place value charts, cross out each digit, and shift the number one place value to the left to show 324.)  
 T: Show 32.4 divided by 10.  
 S: (Write 32.4 on their place value charts, cross out each digit, and shift the number one place value to the right to show 3.24.)  
 Repeat the process and sequence for  $32.4 \times 100$ ,  $32.4 \div 100$ ,  $837 \div 1000$ , and  $0.418 \times 1000$ .

**Write the Unit as a Decimal DOK 1**  
 T: (Write 9 tenths on board.) Show this unit form as a decimal.  
 S: 0.9  
 T: (Write 10 tenths on board.)  
 S: 1.0  
 Repeat the process for 20 tenths, 30 tenths, 70 tenths, 9 hundredths, 10 hundredths, 11 hundredths, 17 hundredths, 57 hundredths, 42 hundredths, 9 thousandths, 10 thousandths, 20 thousandths, 60 thousandths, 64 thousandths, and 83 thousandths.

**Write in Exponential Form**  
 Materials: (S) Personal white board  
 Note: Reviewing this skill in isolation lays a foundation for students to apply it when multiplying during the lesson.  
 T: (Write  $100 = 10^?$ .) Write 100 in exponential form.  
 S: (Write  $100 = 10^2$ )  
 Repeat the process for 1,000, 10,000, and 1,000,000.

**Acceleration/Previewing**  
 (Preview of key vocabulary, concepts, and skills prior to learning)

**Vocabulary:**

1. Conversion
2. Standard/customary measurement system
3. Metric measurement system
4. Estimation
5. Measurement benchmark

T: (Write  $1 \text{ km} = \underline{\hspace{1cm}} \text{ m}$ .) Fill in the unknown number.  
 S: (Write  $1 \text{ km} = 1,000 \text{ m}$ .)  
 Repeat process and procedure for  $1 \text{ kg} = \underline{\hspace{1cm}} \text{ g}$ ,  $1 \text{ liter} = \underline{\hspace{1cm}} \text{ mL}$ ,  $1 \text{ m} = \underline{\hspace{1cm}} \text{ cm}$ .

## Teaching Activities and Strategies

(Examples: Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)

Key Questions: Add throughout the lesson

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
1000 meters kilometers	100 meters hectometer	10 meters dekameter	1 meter	1/10 meter decimeter	1/100 meter centimeter	1/1000 meter millimeter
			0.	0	1	
			0.	0	0	1

T: Here is a set of column headings based on metric length related to our place value chart, designating one meter as the base unit, or the ones place.

T: Use your meter strip to show and explain to your partner the lengths that relate to the tenths, hundredths, and thousandths places. (Move through the tenths, hundredths, and thousandths until identifying and naming meter as 1 millimeter.)

Have students then explain to their partner lengths that relate to the tens, hundreds, and thousands places. For example, 10 meters would be about the length of the classroom, 100 meters about the length of a football field, and 1,000 meters is a kilometer, which may be conceived in relation to the distance to their home from school.

Note: Be sure to establish the following, which essential to the Concept Development lesson:

1 millimeter (mm) = meter (m) = 0.001 meter.

1 centimeter (cm) = meter (m) = 0.01 meter

The relationship of metric lengths to the place value chart will also help students to realize when they are moving from smaller to larger or larger to smaller units. Consider reviewing the multiplicative relationships between the units.

### Problem 1 DOK 1

Rename or convert large units as smaller units using multiplication equations with exponents.

T: (Draw and label a line 2 meters long on the board.)

T: How many centimeters equal 2 meters?

S: 200 centimeters. (Label the same 2 meter point as 200 centimeters. Fill in the first row of the t-chart.)

T: Tell me a multiplication equation multiplying by 2 to get 200.

S:  $2 \times 100 = 200$ .

T: Restate the equation renaming 100 with an exponent.

S:  $2 \times 10^2 = 200$ .

T: With your partner, determine how many centimeters are equal to 1.37 meter. Use your **meter strip** if it helps you. **CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.**

S: It's 1 meter and 37 centimeters.  It's more than 1 meter and less than 2 meters. 37 hundredths of a meter is 37 centimeters.  $100 \text{ cm} + 37 \text{ cm} = 137$



cm.

T: What is the equivalent measure in centimeters?

S: 137 centimeters. (On the board, label the same 1.37 meter point as 137 centimeters. Fill in the second row of the chart.)

T: On your boards, show this conversion using a multiplication equation with an exponent.

S:  $1.37 \cdot 100 = 137$ .  $1.37 \cdot 10^2 = 137$ .

T: What must we do to the number of meters to rename them as centimeters?

S: Multiply the number of meters by 100 or  $10^2$ . (Record the rule on the chart. Repeat with 2.6 meters.)

T: How can we use multiplication to rename a meter as millimeters? Discuss with your partner. **DOK 2**

S: Multiply the number of meters by 1,000 or by  $10^3$ .

T: Take a moment to write multiplication equations with exponents to find the number of millimeters to complete the third column of our chart.

T: Show me your boards.

S: (Show  $2 \cdot 10^3 = 2,000$ ,  $1.37 \cdot 10^3 = 1,370$ , and  $2.6 \cdot 10^3 = 2,600$ .)

T/S: (Fill in the equivalent millimeter measures together.)

T: Explain the difference between A and B to your partner.

**Problem A Problem B**

2 meters  $10^3 = 2,000$  meters  $2 \cdot 10^3 = 2,000$  2 meters = 2,000 millimeters

S: Problem A is not renaming or converting, but multiplying 2 meters by  $10^3$ , so the answer is 2,000 meters. That's more than 2 miles! Problem B is renaming by multiplying 1,000 by 2 because each meter has a thousand millimeters in it. After we multiply, then we can name the unit. That is the exact same measurement as 2 meters.

T: Yes, we are multiplying the number of meters by  $10^3$

Explain why we multiply to rename large units as small units. (Point to the 2-meter line drawn on the board.)

S: 1 meter = 1,000 millimeters, 2 meters = 2,000 millimeters. It's the number of meters that is being multiplied, not the meters. Multiplying didn't make 2 meters into more meters, but renamed the 2 meters as 2,000 millimeters. One meter got chopped up into 1,000 millimeters, so we multiply the number of meters by 1,000. The length stays the same because we're making more units by decomposing a meter, not by making more copies of a meter.

Meters	Centimeters	Millimeters
2	200	2,000
1.37	137	1370
2.6	260	2,600

To rename meters as centimeters, multiply by  $10^2$

To rename meters as millimeters, multiply by  $10^3$

**Problem 2 CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.**

Rename millimeters and centimeters as meters using division equations with exponents.



Again, using the 2-meter line and chart, reverse Problem 1's sequence and convert from smaller to larger units, dividing by  $10^2$  to rename, or convert, centimeters as meters, dividing by  $10^3$  to rename, or convert, millimeters as meters.

Culminate with the same reflection:

T: We are dividing the number of meters by  $10^2$  or by  $10^3$ .

That is a method for renaming centimeters as meters and millimeters as meters. Explain the difference between C and D with your partner.

Problem C Problem D

$$2,000 \text{ mm} \div 10^3 = 2 \text{ m} \quad 2,000 \div 10^3 = 2 \quad 2,000 \text{ mm} = 2 \text{ m}$$

S: 1,000 millimeters = 1 meter, 2,000 millimeters = 2 meters. It's the number of millimeters that is being divided, not the millimeters. Division renamed the 2,000 mm as 2 meters. How many groups of 1,000 are in 2 thousands? 1,000 millimeters got grouped together as 1 meter, so we divide or make groups of 1,000.

Millimeters	Centimeters	Meters
2,000	200	2
1,370	137	1.37
2,600	260	2.6

To rename centimeters to meters, divide by  $10^2$

To rename millimeters to meters, divide by  $10^3$

### Problem 3

A ribbon measures 4.5 meters. Convert its length to centimeters.

A wire measures 67 millimeters. Convert its length to meters.

Note: The most important concept is the equivalence of the two measurements—that is, the length did not change which becomes very apparent when conversions are contextualized. The ribbon and wire are not getting longer or shorter. Clarify this understanding before moving on to finding the conversion equation by asking,

“How can 4.5 and 4,500 represent the same length?”

(While the numeric values differ, the unit size is also different. 4.5 is meters. 4,500 is millimeters. Meters are 1,000 times as large as millimeters. Therefore, it takes fewer meters to represent the same amount as something measured in millimeters.) Lead students to articulate that when converting the number of large units to a number of smaller units, they multiplied, and when converting from small units to larger units, they divided.

### Problem 4

Have students work with a partner to solve the following problems.

	<p><b>CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.</b></p> <p>a. Measure the length in cm of ten Base 10 logs placed end to end. Measure the length a second time in mm. Measure the length a third time using a meter ruler. Repeat 5 times using different numbers of Base 10 logs. Record all measurements in a table with the headings below:          No. of Base 10 Logs -- m -- cm -- mm          Ask them to describe any patterns or relationships that they find among the three metric units used. <b>DOK 2</b></p>
<p><b>Summarizing Strategies</b>          (Learners summarize and answer LEQ)</p>	<p><b>Exit Ticket DOK 1</b></p> <p><b>1. Convert using an equation with an exponent.</b>          a. 2 meters to centimeters <math>2 \text{ m} = \underline{\hspace{2cm}} \text{ cm}</math>          b. 40 millimeters to meters <math>40 \text{ mm} = \underline{\hspace{2cm}} \text{ m}</math></p> <p><b>2. Read each aloud as you write the equivalent measures.</b>          a. A piece of fabric measures 3.9 meters. Express this length in centimeters.          b. Ms. Ramos's thumb measures 4 centimeters. Express this length in meters.</p>
<p><b>Higher Order Thinking Question.</b></p>	<p>In the long jump, Karen can jump 51 inches, Debbie can jump 4 feet 4 inches, and Margaret can jump 1 yard, 1foot, 1 inch. Who can jump the farthest? Use what you know about customary measurement to explain how you found your answer. <b>DOK 2</b></p>
<p><b>Assignment and/or Assessment</b></p>	<p><b>Students will complete the below assignment. They will track their accuracy and speed in their data notebooks. DOK 1</b></p> <p>1. Convert and write an equation with an exponent. Use your meter strip when it helps you.          a. 3 meters to centimeters <math>3 \text{ m} = 300 \text{ cm}</math> <math>3 \times 10^2 = 300</math></p>

- b.  $10^5$  centimeters to meters  $10^5 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$
- c. 1.68 meters to centimeters  $\underline{\hspace{2cm}} \text{ m} = \underline{\hspace{2cm}} \text{ cm}$
- d. 80 centimeters to meters  $\underline{\hspace{2cm}} \text{ cm} = \underline{\hspace{2cm}} \text{ m}$
- e. 9.2 meters to centimeters  $\underline{\hspace{2cm}} \text{ m} = \underline{\hspace{2cm}} \text{ cm}$
- f. 4 centimeters to meters  $\underline{\hspace{2cm}} \text{ cm} = \underline{\hspace{2cm}} \text{ m}$
- g. In the space below, list the letters of the problems where larger units are converted to smaller units.

2. Convert using an equation with an exponent. Use your meter strip when it helps you.

- a. 3 meters to millimeters  $\underline{\hspace{2cm}} \text{ m} = \underline{\hspace{2cm}} \text{ mm}$
- b. 1.2 meters to millimeters  $\underline{\hspace{2cm}} \text{ m} = \underline{\hspace{2cm}} \text{ mm}$
- c. 1,020 millimeters to meters  $\underline{\hspace{2cm}} \text{ mm} = \underline{\hspace{2cm}} \text{ m}$
- d. 97 millimeters to meters  $\underline{\hspace{2cm}} \text{ mm} = \underline{\hspace{2cm}} \text{ m}$
- e. 7.28 meters to millimeters  $\underline{\hspace{2cm}} \text{ m} = \underline{\hspace{2cm}} \text{ mm}$
- f. 4 millimeters to meters  $\underline{\hspace{2cm}} \text{ mm} = \underline{\hspace{2cm}} \text{ m}$
- g. In the space below, list the letters of the problems where smaller units are converted to larger units.

3. Read each aloud as you write the equivalent measures. Write an equation with an exponent you might use to convert.

- a.  $3.512 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$   $3.512 \times 10^3 = 3,512$
- b.  $8 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$
- c.  $42 \text{ mm} = \underline{\hspace{2cm}} \text{ m}$
- d.  $0.05 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$
- e.  $0.002 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

**Assignment 2 :**

- The length of the bar for a high jump competition must always be 4.75 m. Express this measurement in millimeters. Explain your thinking. Include an equation with an exponent in your explanation. **DOK 1**
- A honey bee's length measures 1 cm. Express this measurement in meters. Explain your thinking. **DOK 2**  
Include an equation with an exponent in your explanation.
- Explain why converting from meters to centimeters uses a different exponent than converting from meters to millimeters. **DOK 2**
- A guardrail that runs along a road has sections that are 5 meters long. If the guardrail is 0.5 km long, how many sections are there? **DOK 1**
- Caroline has 6.9 L of lemonade to serve 30 people. How many milliliters should she pour into each glass? Use what you know about metric measurement to explain your answer. **DOK 2**

**Assignment 3 DOK 3CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them.**

Item	Weight
------	--------

laundry detergent	2lbs 10oz
oranges	2lbs 11oz
toothpaste	5oz
pineapple	3lbs 6oz
liquid soap	1lb 1oz
book	7oz
paper tissues	8oz.

**Shopping Bags**

This problem gives you the chance to:

- work with standard units in the customary system

The supermarket's shopping bags can only carry 6 lbs of goods.

Here is Yusef's shopping list.

Yusef has two shopping bags.

He has already put his laundry detergent in one bag and his oranges in the other.

1. Show what other items Yusef can put in the bags so that the bags don't break.

2. What is the weight of the items in Bag #1? \_\_\_\_\_

Show how you figured this out.

3. What is the weight of the items in Bag #2? \_\_\_\_\_

Show how you figured this out.

Bag #1

laundry detergent













Bag #2

Oranges

16oz = 1lb

The teacher will use this rubric to assess: Shopping Bags Rubric
The core elements of performance required by this task are:
• work with standard units in the customary system.
Based on these, credit for specific aspects of performance should be assigned as follows points
1. Gives correct answer: Bag #1 pineapple 1 point
Gives correct answer: Bag #2 toothpaste, liquid soap, book, paper tissues 1 point each
2. Gives correct answer: 6 lbs or 96oz 1 point
Shows correct work for items in their bag, such as: 2lbs 10 oz + 3lbs 6oz. 1 point each
3. Gives correct answer: 5 lbs or 80oz 1 point.

	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Shows correct work for items in their bag,</td> </tr> <tr> <td style="padding: 2px;">such as: 2 lb 11 oz + 5 oz + 1 lb 1 oz + 7 oz + 8 oz 2 points</td> </tr> <tr> <td style="padding: 2px;"> </td> </tr> <tr> <td style="padding: 2px;"> </td> </tr> <tr> <td style="padding: 2px;">Total Points 6</td> </tr> </table> <p><a href="http://www.lauracandler.com/filecabinet/math/PDF/metricicecream.pdf">http://www.lauracandler.com/filecabinet/math/PDF/metricicecream.pdf</a></p> <p><a href="http://www.lauracandler.com/filecabinet/math/PDF/GallonRobotPatterns.pdf">http://www.lauracandler.com/filecabinet/math/PDF/GallonRobotPatterns.pdf</a></p>	Shows correct work for items in their bag,	such as: 2 lb 11 oz + 5 oz + 1 lb 1 oz + 7 oz + 8 oz 2 points			Total Points 6
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such as: 2 lb 11 oz + 5 oz + 1 lb 1 oz + 7 oz + 8 oz 2 points						
Total Points 6						
	<p><a href="https://learnzillion.com/lessons/2571-compare-and-convert-metric-units-of-length">https://learnzillion.com/lessons/2571-compare-and-convert-metric-units-of-length</a></p> <p><a href="https://learnzillion.com/lessons/2862-convert-a-smaller-metric-unit-to-a-larger-unit">https://learnzillion.com/lessons/2862-convert-a-smaller-metric-unit-to-a-larger-unit</a></p>					
<p><b>Differentiation</b></p>	<p>The teacher will observe and collect data on the students over the two day lesson. Students who need assistance with converting from larger units to smaller units will be placed in one group, students struggling with converting smaller units to larger units will be placed in one group, and students who need their learning extended will place Measurement Mania.</p>					
<p><b>Review &amp; Revise (Teacher Reflection)</b></p>	<p>Measurement Mania – Practice game to reinforce converting measurements.  <a href="http://maccss.ncdpi.wikispaces.net/file/view/CCSSMathTasks-Grade5.pdf">http://maccss.ncdpi.wikispaces.net/file/view/CCSSMathTasks-Grade5.pdf</a></p> <p><a href="https://learnzillion.com/lessons/3501-solve-real-world-distance-problems-with-unit-conversions">https://learnzillion.com/lessons/3501-solve-real-world-distance-problems-with-unit-conversions</a></p> <p><a href="http://www.teacherspayteachers.com/Product/FREE-Customary-Measurement-Foldable-533693">http://www.teacherspayteachers.com/Product/FREE-Customary-Measurement-Foldable-533693</a></p> <p><a href="http://www.lauracandler.com/filecabinet/math/PDF/MetricMeasurementShowdown.pdf">http://www.lauracandler.com/filecabinet/math/PDF/MetricMeasurementShowdown.pdf</a></p> <p><a href="http://www.lauracandler.com/filecabinet/math/PDF/CustomaryMeasurePractice.pdf">http://www.lauracandler.com/filecabinet/math/PDF/CustomaryMeasurePractice.pdf</a></p>					

Resources & Materials	<p><b>Metric System</b>          - is a decimal system of measurement. To convert metric units, <u>multiply or divide</u> by <u>powers of 10</u>.</p> <p>Length:</p> <p>1 centimeter = 10 millimeters          1 meter = 100 cm or 1,000 mm          1 kilometer = 1,000 meters</p> <table border="1"> <tr> <td>millimeter</td> <td>centimeter</td> <td>meter</td> <td>kilometer</td> </tr> <tr> <td>width of a dime</td> <td>width of a pencil eraser</td> <td>height of a desk</td> <td>city blocks</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>	millimeter	centimeter	meter	kilometer	width of a dime	width of a pencil eraser	height of a desk	city blocks					
millimeter	centimeter	meter	kilometer											
width of a dime	width of a pencil eraser	height of a desk	city blocks											
														

## Decision 7: Extending Thinking Lesson

(Lesson plan for extending thinking lesson involving higher level thinking skills.  
 You would only have a few of these per unit.)

**Unit Topic:**

**Standards:**

**Anchors:**

Lesson Essential Question	
Time (Days)	
Mini-Lesson (Quick lesson prior to activity.)	
Activity or Task (Details of activity.)	

<b>Summarize/Share</b> (Learners summarize and answer LEQ)	
<b>Assignment and/or Assessment</b>	
<b>Differentiation</b>	
<b>Revise/Review</b> (Teacher Reflection)	
<b>Resources &amp; Materials</b>	

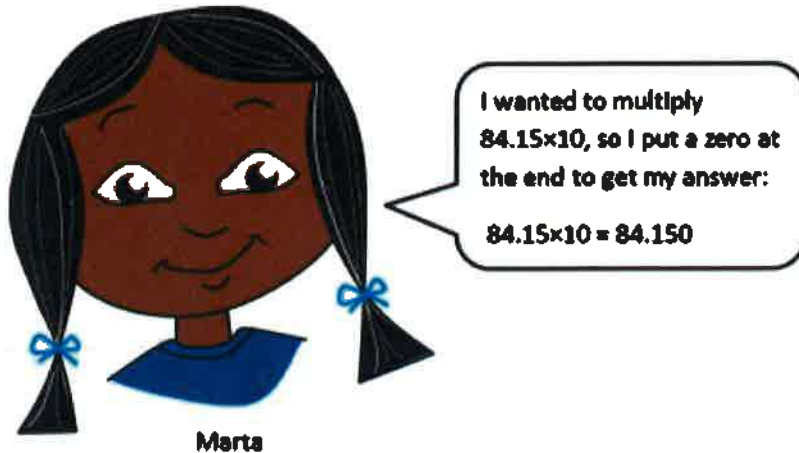
# 5<sup>th</sup> Grade Unit 1- Summative Assessment

1a.) Explain why  $0.4 \times 10 = 4$ .

1b.) Explain why  $3.4 \times 10 = 34$ .

Draw pictures to illustrate your answer.

2.) Marta made an error while finding the product  $84.15 \times 10$ .



In your own words, explain Marta's misunderstanding. Please explain what she should do to get the correct answer and include the correct answer in your response.

3.a.) Kipton has a digital scale. He puts a marshmallow on the scale and it reads 7.2 grams. How much would you expect 10 marshmallows to weigh? Why?

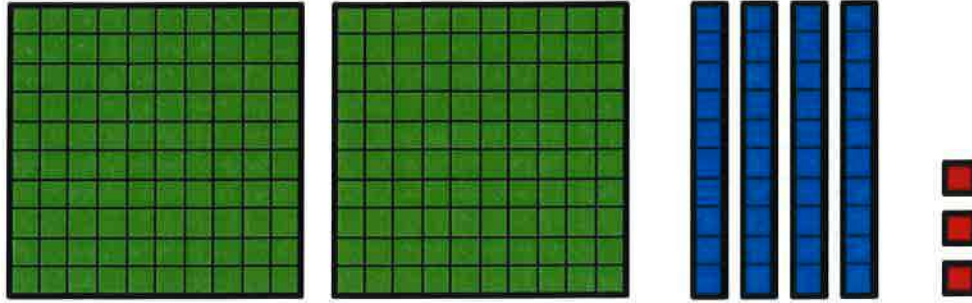
3b.) Kipton takes the marshmallows off the scale. He then puts on 10 jellybeans and then scale reads 12.0 grams. How much would you expect 1 jellybean to weigh? Why?

3c.) Kipton then takes off the jellybeans and puts on 10 brand-new pink erasers. The scale reads 312.4 grams. How much would you expect 1,000 pink erasers to weigh? Why?



# 5<sup>th</sup> Grade Unit 1- Summative Assessment

4.) Netta drew a picture on graph paper:



She said, *In my picture, a big square represents 1. Since ten rectangles make a big square, a rectangle represents 0.1. Since 100 little squares make a big square, a little square represents 0.01. So this picture represents 2.43.*

a. Is Netta Correct?

Manny said,

*I drew the same picture, but in my picture, a little square represents 1, so this picture represents 243.*

b. Name some other numbers that this picture could represent. For each of these numbers, what does a little square represent? What does a rectangle represent? What does a big square represent? Explain.

c. Draw a picture to represent 0.047

5.) Historians estimate that there were about 7 million people on the earth in 4,000 BCE. Now there are about 7 billion! We write 7 million as 7,000,000. We write 7 billion as 7,000,000,000. How many times more people are there on the earth now than there were in 4,000 BCE?

6.) There is 150 meters of wrapping paper in a box. 61 meters, 9 cm of it is red. The rest is green. How much wrapping paper is green?

7.) Explain the relationship between the two 5's in the number 455,721.

8.) Write an equation and solve the story problem below.

At the grocery store, 2 pounds of turkey costs \$21.64. How much would 20 pounds of turkey cost?

9.) 500 is ten times larger than 50. Is this statement true or false? Explain your reasoning.

10.) 123,456

Given any 6-digit number like the above, describe what happens to the value of a digit as it moves up and/or down the place values. You may use words, diagrams, and/or examples in your explanation.

11.) 184.36      9,027.83

Which number has the smaller value of the 8? How many times smaller is it? Use what you know about place value to explain.

# 5<sup>th</sup> Grade Unit 1- Summative Assessment

12.) 184.36

Generate a number that has a digit in the tenths place that is  $\frac{1}{100}$  times smaller than the 8 in the hundreds place.

---

Use what you know about place value to justify your answer.

13.) Select all the correct responses that equal  $10^4$ ? Write the steps you took to solve the answer in sequential order.

a.  $100 \times 10^2$

b.  $1,000 \times 10^1$

c. 10,000

d.) 100,000

14.) Write 61, 204 in expanded form using exponents.

15.) Which is another name for:

$$(7 \times 10^3) + (4 \times 10^4) + (2 \times 10^1) + (9 \times 1)$$

16.) Cameron began with \$10 in investments and was able to "triple" his money. Arlene also began with \$10. She was able to "cube" her money. Who ended up with more money? Explain.

Use what you know about powers of ten and exponents to explain your answer.

17.) Solve the problems below.

$34 \times 10^1 =$

$34 \div 10^1 =$

$34 \times 10^2 =$

$34 \div 10^2 =$

$34 \times 10^3 =$

$34 \div 10^3 =$

$34 \times 10^4 =$

$34 \div 10^4 =$

# 5<sup>th</sup> Grade Unit 1- Summative Assessment

What pattern did you notice when you multiplied by powers of 10? Is this pattern the same for dividing by powers of 10? Justify your answer.

18.) Write a number that fits each description below.

A number greater than 40 with a 5 in the tenths place.	
A number between 200 and 300 with a 7 in the thousandths place and a 2 in the hundredths place.	
A number greater than 18.55 and less than 18.6	
A number equivalent to 63.24	
A number that has a three in the hundredths place.	

19.) In the long jump, Karen can jump 51 inches, Debbie can jump 4 feet 4 inches, and Margaret can jump 1 yard, 1 foot, 1 inch. Who can jump the farthest?

20.) One can of soda has a capacity of 355 mL. How many liters of soda do 8 cans contain? Use what you know about metric measurement to explain your answer.

21.) Nutritionists recommend drinking eight glasses of water each day. If a glass holds 250 mL, does the recommended daily water intake exceed 1L? Use what you know about metric measurement to explain your answer.

22.) Caroline has 6.9 L of lemonade to serve 30 people. How many milliliters should she pour into each glass? Use what you know about metric measurement to explain your answer.

# 5<sup>th</sup> Grade Unit 1- Summative Assessment

23.) A guardrail that runs along a road has sections that are 5 meters long. If the guardrail is 0.5 km long, how many sections are there? Use what you know about metric measurement to explain your answer.

# 5<sup>th</sup> Grade Unit 1- Summative Assessment

## Answer Guide/Key Summative Assessment

1. Teacher will examine the illustrations and explanations for mastery of the concept. Teachers will specifically look for evidence of understanding the concept of moving the decimal point and in which direction to move it for multiplication. The teacher will check the illustrations for evidence of moving the decimal points or for models that match the equations.
2. Teacher will review the error analysis response for understanding of what Mart did incorrectly by not moving the decimal point and simply adding the zero at the end. The teacher will examine the response for the correct steps when multiplying by zero. The response should include moving the decimal point to the right one place when multiplying by zero.
3. The teacher will examine the mathematical processes for multiplication and division.

3a.) 72 grams

3b.) 1.2 grams

3c.) 31,240 grams

4. Students should be able to explain why Netta is correct for her model. They should be able to demonstrate understanding of the big square, rectangles, and units.

4b.) The teacher will check the students explanation and for other representations of the shapes. Reasonable explanations that demonstrate mastery of place values will be accepted.

4c.) The teacher will check the students illustration and explanation.

5.) Billions

$$10^9 = 1,000,000,000$$

$$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1,000,000,000$$

Millions

$$10^6 = 1,000,000$$

$$10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1,000,000$$

The teacher will check for understanding of the above concepts.

6.) 88.91 meters

7.) The teacher will check for understanding of the relationship between the ten thousands and thousands place.

8.) \$216.40

9.)  $50 \times 10 = 500$  The teacher will check the students reasoning of this relationship.

10.) Student will supply any six digit number and explain what happens to the value of numbers as it relates to the value of different place value positions.

11.) 9,027.83 Almost 80 times as much. The teacher will check the students explanation for mastery of the relationship between the places.

12.) The teacher will check the student's number to ensure that it is smaller than the 8 in the tens place. The teacher will check for understanding as the students justify their answer.

13.) Teacher should select a,b, and c. The teacher will check the students understanding and steps to solve.

14.) The teacher will check for student understanding.

15.) 47, 029

16.) Arlene. The teacher will check for the explanation.

17.) 340

3,400

34,000

340,000

3.4

.34

.034

.0034

18.) The teacher will check for understanding regarding understanding of the numbers.


19.) Debbie. Teacher will check for student explanation.

20.) 2.84 liters. Check for explanation

21.) Yes. The teacher will check students math and explanation.

22.) 230 ml. The teacher will checks students explanation.

23.) 100 sections. The teacher will check for students math and explanation.

<p><b>4.0</b></p>	<p><b>In addition to score 3.0 performance, in-depth inferences and applications that go beyond instruction to the standard.</b>  <b>The student will:</b></p> <ul style="list-style-type: none"> <li>• Apply and extend understandings of numbers to the system of rational numbers</li> </ul> <p><b>No major errors or omissions regarding the score 4.0 content.</b></p>
	<p><b>3.5</b> In addition to score 3.0 performance, in-depth inferences and applications with partial success</p>
<p><b>3.0</b></p> 	<p><b>The student will understand the place value system, including:</b></p> <ul style="list-style-type: none"> <li>• Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left</li> <li>• Explain patterns in the number of zeros of the product when multiplying a number by powers of 10</li> <li>• Explain patterns in the placement of a decimal point when a decimal is multiplied or divided by a power of 10</li> <li>• Use whole number exponents to denote powers of 10</li> <li>• Read, write, and compare decimals to thousandths using base-ten numerals, number names, and expanded form</li> <li>• Compare two decimals to thousandths based on meanings of the digits in each place.</li> <li>• Convert among different sized standard measurement unit within a given measurement system.</li> <li>• Use these conversions to solve real-world multi-step problems.</li> </ul>
	<p><b>2.5</b> No major errors or omissions regarding 2.0 content and partial knowledge of 3.0 content.</p>
<p><b>2.0</b></p>	<p><b>The student recognizes and describes specific terminology such as:</b></p> <ul style="list-style-type: none"> <li>• power of 10, exponent, numeral, expanded form, round, place value</li> </ul> <p><b>The student will:</b></p> <ul style="list-style-type: none"> <li>• Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right</li> <li>• Read, write, and compare multi-digit whole numbers using base-ten numerals, number names, and expanded form</li> <li>• Compare numbers based on meanings of the digits in each place.</li> </ul>
	<p><b>1.5</b> Partial knowledge of the score 2.0 content, but major errors or omissions regarding score 3.0 content.</p>
<p><b>1.0</b></p>	<p>With help, a partial understanding of some of the simpler details and processes and some of the more complex ideas and processes.</p>
	<p><b>0.5</b> With help, partial understanding of the score 2.0 content, but not the score 3.0 content.</p>
<p><b>0.0</b></p>	<p>Even with help, no understanding or skill demonstrated.</p>