Task: Tiles for the Teacher	**3rd Grade**
Joe is bagging tiles for his teacher, Ms. Brown. She plans to use the tiles to work with small groups of 8 students. Ms. Brown needs 15 tiles per student for tomorrow's small group math lesson. She asks Joe to tell her how many tiles he will need for a group of 8 students. Joe does not know all of the multiplication facts for 8 yet. He has only learned the multiplication facts for zero through 5 and the 10s. How can Joe figure out how many tiles he needs for the 8 students without counting them? Draw a picture to represent your solution and explain your work**.**	

Teacher Notes:

- Multiplication is a fundamental operation that is used to solve everyday problems. Considering examples makes it easy to understand why multiplication is an appropriate choice in many different problem situations. In fact, research suggests that beginning with problem situations helps students develop competence in computation and problem solving (Fuson, 2003).
- An understanding of the operation of multiplication builds on ideas about place value, addition, and skip counting.
  The base-ten numeration system is fundamental to understanding numbers and any written or mental algorithm with whole numbers.
- These are key topics in the primary grades, where students learn that 23 is 2 tens and 3 ones, which they later write in expanded notation as 2 x 10 + 3 x 1. In this expression, 2 is the scaling factor that tells how many tens, and 3 is the scaling factor that tells how many ones. When students learn to add 23 and 35, they add each place value separately. The connections of multiplication to place value are integrated into the addition algorithm through the use of the distributive property, together with the commutative and associative properties for addition:

23 + 35 = (2 x 10 + 3) + (3 x 10 + 5)	Place value
= (2 x 10 + 3 x 10) + (3 + 5)	Addition properties
= 5 x 10 + 8	Distributive property
= 58	Place value

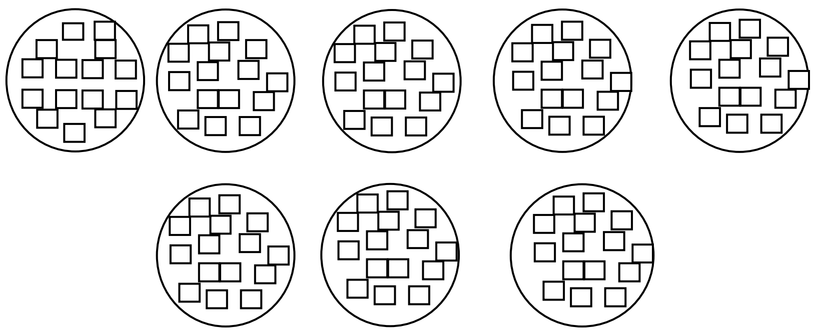
- Understanding the interplay of place value and the operations of addition and multiplication is a major part of developing a robust understanding of whole number operations and is critical to decomposing factors and combining partial products.(*Developing Essential Understandings for Teaching Mathematics in Grades 3-5 Multiplication and Division;* National Council of Teachers of Mathematics, 2011)

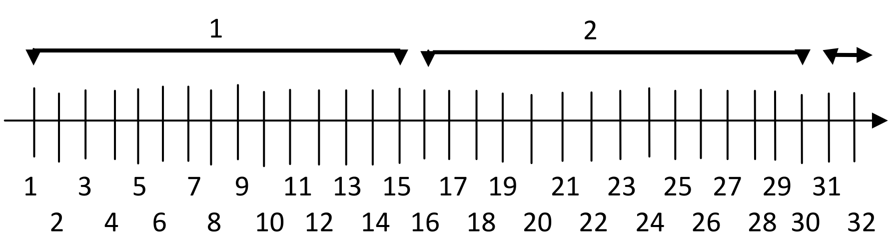
Common Core State Standards for Mathematical Content	**Common Core State Standards for Mathematical Practice**
3. OA.A.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* 3. OA.A.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. 3. OA.B.5 Apply properties of operations as strategies to multiply and divide. *Example: If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known. (Commutative property of multiplication.) 3 × 5 × 2 can be found by 3 × 5 = 15, then 15 × 2 = 30, or by 5 × 2 = 10, then 3 × 10 = 30. (Associative property of multiplication.) Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find 8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56. (Distributive property.)* 3.0A.B.6 Understand division as an unknown-factor problem. For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

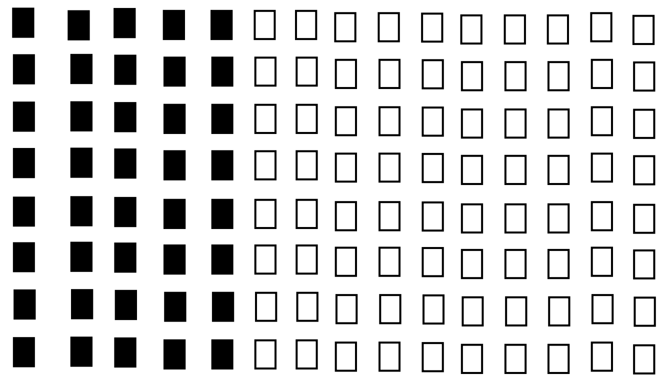
Essential Understandings

- Multiplication can be used to find the total number of objects when there are a specific number of groups with the same number of objects.
- Each multiplicative expression developed in the context of a problem situation has an accompanying explanation, and different representations and ways of reasoning about a situation can lead to different expressions or equations.

Explore Phase

Possible Solution Paths	**Assessing and Advancing Questions**
Student may draw 8 bags and distribute tiles one at a time until each bag has 15 tiles. Count for the total number of tiles. 	<u>Assessing Questions:</u> Tell me how you decided to use the numbers 8 and 15, what were you thinking? <u>Advancing Questions:</u> Can you think of a faster way to find the total number of tiles? Can you write a multiplication problem that would represent your drawing? What is the relationship between addition and multiplication?
Student may break the numbers 15 and 8 into smaller numbers to fit the multiplication facts that are known. 8 bags = 5 bags + 3 bags 15 tiles = 5 tiles + 10 tiles 5 bags x 5 tiles = 25 tiles 3 bags x 5 tiles = 15 tiles 5 bags x 10 tiles = 50 tiles 3 bags x 10 tiles = 30 tiles The total number of tiles needed for 8 bags is 120	<u>Assessing Questions:</u> Why did you select the numbers you used for bags and tiles? What do the numbers represent? <u>Advancing Questions:</u> Are there any other number combinations you could have used? How do you know you can use them?
Student may break the numbers 15 and 8 into smaller numbers to fit the multiplication facts that are known and add to find the total. 4 bags and 4 bags = 8 bags	<u>Assessing Question:</u> Why did you select the numbers you used? What do the numbers represent?

5 tiles and 10 tiles = 15 tiles I know that 4 is one-half of 8. I know that 4 x 5 is 20 and 4 x 10 is 40 so there would be 60 tiles in 4 bags or 60 tiles in one-half of the bags. 60 + 60 = 120 tiles for 8 bags. I know that 15 and 15 is 30 so I know that 2 bags will contain 30 tiles. I know that 2 x 4 = 8 so I can multiply 30 (contents of 2 bags) x 4 to find the number in 8 bags. I know that 30 is 10 + 10 + 10. I know that 4 bags x 10 tiles is 40 so 40 + 40+ 40 is the same as 30 x 4 or 120 tiles. I know that 15 is the same as 10 + 5. I know that 8 bags x 10 tiles = 80 tiles. I know 5 x 8 can be broken into 5 x 4 two times. 5 x 4 = 20 and 5 x 4 = 20 because 8 = 4 + 4. I know to add 80 for the ten tiles and 20 and 20 for the 5 tiles. The total is 120 tiles for 8 bags of 15 tiles. Students may find other combinations to demonstrate the associative and distributive properties of multiplication.	<u>Advancing Question:</u> Can you show/explain another way to solve the problem? Can you use other numbers to solve this problem?
Student may use a number line to mark of sections of 15 eight times. 	<u>Assessing Question:</u> What made you think of using a numberline? How did you use the numbers 8 and 15? <u>Advancing Question:</u> Would it make sense to show 15 sets of 8? How would you explain why?
The student could make an array showing 8 bags and 15 tiles.	<u>Assessing Question:</u> Did you use multiplication or did you count the tiles? How does the array represent the bags and tiles? (labels needed) Is there a way to shade the tiles so that you can show how to use combinations of smaller numbers to multiply?

<table>
<tr>
<td>Bags (8) 

Tiles (15)

Without shading 8 x 15 = 120
or
Using shading : 5 x 8 = 40 and 10 x 8 = 80 so 15 x 8 = 120</td>
<td><u>Advancing Question</u>: Can you show different ways to shade the array to represent different combinations of the numbers?
What would happen if you turned your array sideways?</td>
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<td>Possible Student Misconceptions</td>
<td></td>
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<td>Student does not recognize the ability to break the larger numbers into smaller facts that they are familiar with.

Multiplication errors.</td>
<td><u>Assessing Questions</u>: If Joe does not know multiplication facts for 8, is there a way that he could break the 8 into parts for facts that he does know? What can he do for the number 15?

<u>Advancing Question:</u> Will breaking a larger number into parts that you know the multiplication facts for always work?</td>
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<tr>
<td>Entry/Extensions</td>
<td>Assessing and Advancing Questions</td>
</tr>
<tr>
<td>If students can’t get started….</td>
<td><u>Assessing Question:</u> What does this problem want you to find? How many bags do you need? How many tiles are needed for one bag? How can you use this information to solve the problem? What model could you draw to help you solve this problem?
<u>Advancing Question</u>: If you cannot multiply 15 x 8, is there a way you can use smaller numbers for the facts that you know?</td>
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<td>If students finish early….</td>
<td><u>Assessing Question</u>: Did you check your work to make sure you answer shows/represents what the question wants you to find out?
Does your answer make sense?
<u>Advancing Question:</u> Can you write any “rules” that you would tell someone to use to break numbers into parts for facts that they know?</td>
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Discuss/Analyze
Whole Group Questions
• How were the strategies that you shared similar and different? • How did you know that you could break the numbers into smaller combinations? • How is it helpful to break the numbers into smaller combinations? • Does it matter what combinations you use? Can you explain? • Can you suggest any rules for making the number combinations? Can you use any numbers? • Is it helpful to label the numbers to show what they represent? If so, can you explain why? • If you break the number 15 into 5 and 10 so you can do the multiplication, does the order in which you multiply matter? • What is the relationship between addition and multiplication?