

Math: Grade 5, Lesson 16, Volume

**Lesson Focus:** Unit Cubes and Solid Figures

**Practice Focus:** Students will focus on practicing with unit cubes in order to understand concepts of volume measurement.

**Objective:** Students will use visual representations of unit cubes to mentally construct solid figures with a focus on the understanding of a unit cube as the length, width, and height.

**Key Vocabulary:** unit cube, rectangular prism, faces, edges, length, width, height

**TN Standards:** 5.MD.C.3a

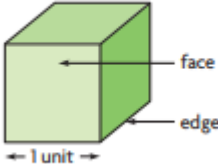
**Teacher Materials:**

- Paper/pencil or board/marker
- Student Practice Packet
- Eight 1 cm Unit cubes for reference
- Square tile for reference
- Various examples of rectangular prisms

**Student Materials:**

- Paper and a pencil, and a surface to write on

Teacher Do	Student Do
<p><u>Opening</u> (1 min)</p> <p><b>Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 5<sup>th</sup> graders out there, though all children are welcome to tune in. This lesson is the sixteenth in our series.</b></p> <p><b>My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!</b></p> <p><b>If you didn't see our previous lesson, you can find it on the TN Department of Education's website at <a href="http://www.tn.gov/education">www.tn.gov/education</a>. You can still tune in to today's lesson if you haven't see any of our others. But, it might be more fun if you first go back and watch our other lessons since we'll be talking about things we learned previously.</b></p> <p><b>Today we will be learning about unit cubes in order to understand concepts of volume measurement in mathematics! Before we get started, to participate fully in our lesson today, you will need:</b></p> <ul style="list-style-type: none"> <li>• Paper and pencil</li> <li>• The student activity packet for Math, Grade 5, Lesson 16 which can be found at <a href="http://www.tn.gov/education">www.tn.gov/education</a>.</li> </ul>	<p>Students get materials ready for the lesson.</p>

<p><b>Ok, let's begin!</b></p> <p><u>Intro</u> (5 min.)</p> <p>[Show students a 1 cm unit cube.]</p> <p><b>Do you recall the name of this solid figure?</b> [Pause.]  <b>You're right! This is a cube</b> [Point to cube.]  <b>Another name for a cube is rectangular prism. Here are some examples of rectangular prisms</b> [Show examples such as tissue box, shoe box, cereal box, dice, etc.]  <b>Can you think of any more examples of rectangular prisms?</b> [Pause.]</p> <p><b>Great!</b>  <b>Notice that rectangular prisms all have 6 faces and 12 edges.</b></p> <p><b>If we wanted to measure the space of one of these faces</b> [Point to one face of your rectangular prism.], <b>what would we be measuring?</b> [Pause.]  <b>Yes, we would be measuring area.</b>  <b>When we measure to find area, we use square units to determine that amount of surface space covered which is the area; area is measured in square units</b> [Show a square tile].  <b>If we want to measure the amount of space inside one of these rectangular prisms, what would we be measuring?</b> [Pause.]  <b>Yes, we would be measuring volume. When we measure volume, we measure in cubic units</b> [Hold up unit cube.]</p> <p><b>How is a unit square the same as a unit cube?</b> [Pause.]  <b>They both have 2 dimensions of length and width.</b>  <b>What does a unit cube have that a unit square does not?</b> [Pause.]</p> <p><b>Yes! A unit cube has 3 dimensions: length, width, and height!</b>          [Point out each dimension on one of your example rectangular prisms and/or show the diagram below.]</p> 	<p>Students examine various examples of rectangular prisms, with a focus on a unit cube with a side length of 1 cubic unit.</p> <p>This introduction helps establish students' spatial structuring with the introduction of a third dimension.</p>
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[Hold up the unit cube.] **The length, width, and height of one-unit cube is 1 cubic unit.**

**We can stack unit cubes to make solid figures. Could we make a rectangular prism by stacking unit cubes?** [Pause.]

**Let's try it!**

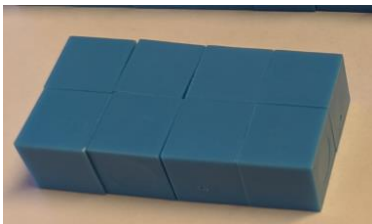
**I have 8 unit cubes** [Display 8 cubes].

**How can I arrange them to create a rectangular prism?**  
[Pause.]

**Hmm, I could arrange them in a row to make a rectangular prism that's 8 unit cubes long.** [Model.]



**I could arrange them into 2 rows of 4 to make a rectangular prism that's 4 units long and 2 units wide.** [Model.]



**Or, I could stack them to make a rectangular prism that's 4 unit cubes long, 1 unit wide, and 2 unit cubes high.** [Model.]



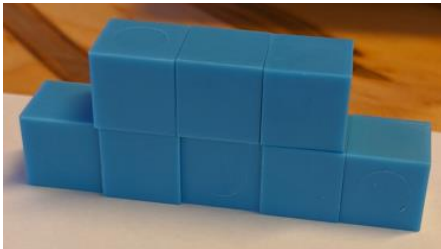
**Can you think of any other ways I could arrange all 8 cubes to make a rectangular prism?** [Pause.]

**Did you say something about changing the orientation of prisms I already made? Very creative!**

**What if I arranged a row of 5 cubes, and stacked a row of 3 cubes on top? Would that make a rectangular prism? [Pause.]**

**No? Why not? [Pause.]**

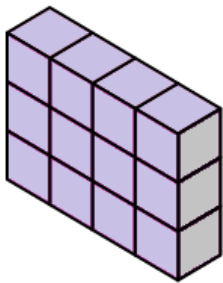
**Oh, of course! Because a rectangular prism has to have the same number of unit cubes in each row. Otherwise, it isn't a rectangular prism! [Model.]**



Teacher Model (10 min.)

Objective 1: The teacher will explicitly instruct and model how to determine the number of unit cubes

**Let's look at another example of a rectangular prism. [Display image.]**



**In this drawing, I can tell that this figure has three-dimensions: it has length, width, and height [Point out each.]**

**If I wanted to recreate this rectangular prism, how many unit cubes would I need? [Pause.]**

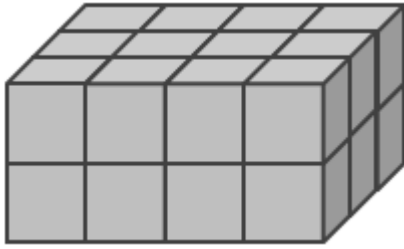
**Did you say 12? [Pause.]**

**You're right, I would need 12 unit cubes to make this rectangular prism. I can count each of the unit cubes in each row even though I can't actually see all 6 faces of the unit cubes. [Model counting each unit cube, pointing to or marking each cube as you count.]**

Objective #1:

Students will count to determine how many unit cubes are in a solid prism in order to build an understanding of the concept of volume measurement.

**Look at this rectangular prism.** [Display the following image.]



**What are some things that you notice?** [Pause.]

**I notice that while I can see 3 of the faces of this prism, some of the faces are hidden from view. Even though we don't see the base, the back, and one of the side faces, we can visualize them by thinking about equal rows of the stacked unit cubes with no gaps between.** [Pause.]

**Can you tell me how many unit cubes I would need to recreate this rectangular prism?** [Pause.]

**Did you say I would need 24 unit cubes? Let's check.** [Count the cubes out loud bringing explicit attention to the cubes hidden from view.]

**You're right! I would need 24 unit cubes to recreate this rectangular prism!**

Objective 2: Teacher will model how to determine the length, width, and height of rectangular prism.

[Display an image like the one below.]



**Now if I want to recreate this next solid figure, I'd want to know how many unit cubes I need. First let's make a prediction. Look at the figure. How many unit cubes do you think I will need?** [Pause.]

**Good guess! Let's find out!**

**To find out, I have to count each cube even though I can't actually see each entire cube.**

**I'll count the number of unit cubes.** [Count the cubes aloud, marking the number or pointing to each cube as you count.]

[Utilize the following sentence stems for the following think-aloud. As the directions below indicate, write these or have

Objective #2:

Students will connect the previous work with unit cubes to the three dimensions of rectangular prisms.

them displayed so that they can be filled in during the think-aloud.]

The length of the prism is 8 unit cubes.

The width of the prism is 2 unit cubes.

The height of the prism is 1 unit cube.

The number of unit cubes used to build the rectangular prism is 16.

**So, what is the length of this rectangular prism?** [Pause.]

**Let's count together to find out!**

**The length is 1, 2, 3, 4, 5, 6, 7, 8. It is 8 units long** [Record this information on the sentence frame.]

**What is this rectangular prism's width? Let's count.**

**1, 2. It's 2 units wide** [Record this information on the sentence frame.]

**Now I'm wondering what the height is. Let's count!**

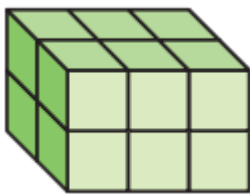
**1. The height is 1 unit high.** [Record this information on the sentence frame.]

**Let's look at another figure** [Display the following rectangular prism with the sentence frames.]

**Do you remember what we call this solid figure?** [Pause.]

**Good job! It's a rectangular prism!**

**If I want to recreate this rectangular prism, I wonder how many unit cubes I would need. I'll count the number of unit cubes.** [Count the cubes aloud, marking the number on each cube as you count.]



This rectangular prism is made up of     unit cubes.

This rectangular prism is     units long.

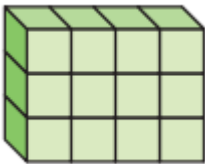
This rectangular prism is     units high.

This rectangular prism is     units wide.

**This rectangular prism is made up of 12 unit cubes.**

[Count and touch corresponding cubes for the following think aloud.]

**Hmmm, what is the length of this rectangular prism?** [Pause.]

<p><b>Let's count together to find out!</b>  <b>The length is 1, 2, 3. 3 units long</b> [Record this information on the sentence frame.]</p> <p><b>Now I'm wondering what the height is. Let's count!</b>  <b>1, 2. The height is 2 units high.</b> [Record this information on the sentence frame.]</p> <p><b>What is this rectangular prism's width? Let's count.</b>  <b>1, 2. 2 units wide</b> [Record this information on the sentence frame.]</p> <p>Tying the learning together:  <b>Let's think about how a unit square the same as a unit cube.</b>          [Pause.]  <b>They both have dimensions of length and width.</b>  <b>What does a unit cube have that a unit square does not?</b>          [Pause.]</p> <p><b>Yes! A unit cube has 3 dimensions: length, width, and height!</b>  <b>The length, width, and height of one-unit cube is 1 unit.</b></p> <p><b>Let's look at some more examples together.</b></p>	<p>Tying the learning together:          Students will listen to the teacher do a think aloud working a contextual problem modeling the thought process for a problem from the start of the problem through finding the solution.</p>
<p><u>Guided Practice</u> (10 min.)</p> <p>[I do.]  <b>If you have a pencil and paper, work through this problem along with me.</b> [Write the following problem and think aloud.]</p>  <p>This rectangular prism is made up of __ unit cubes.          This rectangular prism is __ units long.          This rectangular prism is __ units high.          This rectangular prism is __ units wide.</p> <p>[Count and touch corresponding cubes and fill in the sentence stems for the following think aloud.]</p>	<p>[I do.]          Students work alongside the teacher as the teacher thinks aloud.</p>

This rectangular prism is made up of 12 unit cubes.

Wait! The example we just looked at last was also made up of 12 unit cubes! [Refer to the previous image.]

How can both figures be made up of the same number of unit cubes, yet look quite different? I think we should keep that in mind as we answer the rest of the questions.

What is the length of this rectangular prism? [Pause.]  
Count with me. 1, 2, 3, 4. It is 4 units long.

What is the width of this rectangular prism? [Pause.]  
Count with me. 1. It's 1 unit wide.

What is the height of this rectangular prism? [Pause.]  
Count with me. 1, 2, 3. It's 3 units high.

Let's think back to that noticing we just made: How can both figures be made up of the same number of unit cubes, yet look quite different from each other? What do you think? [Pause.]

Oh, good connection! I like the way you're thinking!  
Although the 2 rectangular prisms are made up of the same number of unit cubes, their lengths, widths, and heights are different.

Here's a similar problem:  
[We do.]

Work through this problem along with me. [Write the following problem or display image.]



This rectangular prism is made up of \_\_\_ unit cubes.  
This rectangular prism is \_\_\_ units long.  
This rectangular prism is \_\_\_ units high.  
This rectangular prism is \_\_\_ units wide.

[We do.]

Students will respond to teacher questions with less scaffolding than the previous example. Students will have more time to think and respond on their own prior to the teacher providing solutions.



First, we need to count the number of unit cubes that make up this rectangular prism. But some of the unit cubes are hidden from our view! Which unit cubes can we see? [Pause.] Interesting! The unit cubes we see are in the front, one side, and the top, but the cubes that we see here on the top are supported by unit cubes that are hidden from our view. When we're determining the number of unit cubes that make up a figure, we can't forget to count the cubes we can't see!

**Count with me.** [Touch each visible cube as you count, then count the ones you don't see.]

**What is the length of this rectangular prism?** [Pause.]  
**Count with me.** 1, 2. It's 2 units long.

**What is the width of this rectangular prism?** [Pause.]  
**Count with me.** 1,2. It's 2 units wide.

**What is the height of this rectangular prism?** [Pause.]  
**Count with me.** 1, 2, 3. It's 3 units high.

This rectangular prism is made up of 12 unit cubes.

[You do.]

**Now, it's your turn to solve on your own! After you've had a few minutes to work, we'll come back together and check it. Ready?** [Pause.]

**Great! Here's your problem:** [Display and read aloud.]

This rectangular prism is made up of \_\_\_ unit cubes.  
This rectangular prism is \_\_\_ units long.  
This rectangular prism is \_\_\_ units high.  
This rectangular prism is \_\_\_ units wide.



[You do.]

Students are working almost exclusively independently with the teacher providing answers at the end.

**Work on your own for about 2 minutes. Then, we'll come back together.**

[After approximately 1 minute, alert students that you will come back together in 1 more minute.]

**Are you ready for us check your work?** [Pause.]

**Okay, great!**

[Display the following as you and the student check work together.]

**Did you add up every unit cube?** [Pause.]

**Yes! Good, were there any hidden cubes?** [Pause.]

**Yes, there were. Good work!**

**How many unit cubes did you count in all?** [Pause.]

**Did you say 18 unit cubes?** [Pause.]

**Excellent!**

**How many units long?** [Pause.]

**Yes, it's 3 unit long! And how many units wide?** [Pause.]

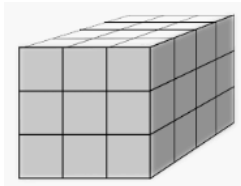
**You're right, it's 2 units wide! How many units high?** [Pause.]

**Good job! It's 3 units high.**

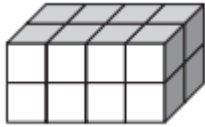
**Great work, everyone!**

Additional Problems (if needed):

Count the number of cubes used to build each solid figure.  
Remember to count any hidden unit cubes.



- 1.
2. Find the number of cubes used to build the solid figure and find the length, width, and height.

	
<p><u>Independent Practice</u> (1 min.)</p> <p><b>Great work, boys and girls! Today, we reviewed the meaning of a unit cube and rectangular prism. I hope you're seeing some connections to the length, width, and height measurements and the number of cubes in a solid figure! You sure did a great job! After the video, you will have some problems to practice on your own. I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, <a href="http://www.tn.gov/education">www.tn.gov/education</a>. [Teacher shows student practice page under document camera or camera zooms in on student practice page.]</b></p> <p><b>Good luck and do your best!</b></p>	
<p><u>Closing</u> (1 min)</p> <p><b>Boys and Girls, I enjoyed reviewing unit cubes to mentally construct solid figures with a focus on the understanding of a unit cube as the length, width, and height with you! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series! Bye!</b></p>	

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