

## General Information

### Lesson Parts & Duration

Total Duration: 1 hour

- Volume of Geometric Solids: Introduction to geometric vocabulary and the formula for finding the volume of right rectangular prisms

### Subject(s)

- Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. (5.MD.5)

### Objective

- Students will be able to identify the elements of a right rectangular prism: vertex, edge, base, face.
- Students will apply their multiplication and addition skills to find the volume of a right rectangular prism with whole-number edge lengths.

### Materials

- blank paper (2 per student)
- pencil & crayons/colored pencils
- right rectangular prism model or a rectangular tissue box
- document camera/projector or whiteboard
- **Optional:** printable “Exit Slip” (page 7)
- **Optional:** printable “Volume” practice sheet (page 8)
- **Optional:** printable “Break Up Your Day” brain/movement break ideas (page 9)

### Instructional Setting

- Students should be seated with or near another student for partner work.

#### Throughout this lesson, you will find:

- ☀ **Scripted Text** indicates things that need to be said directly. Bullets starting with a “T” followed by *italicized type* indicate scripted text
- ☀ **Clarifiers** within scripted text are in orange
- ☀ **Teacher Directions** indicate things you should be doing
- ☀ **Side notes** provide helpful hints, ELL strategies, differentiation and information
- ☀ **Break Up Your Day** (Brain/Movement Breaks) are in green boxes (at the end)

#### Remember!

Quality over quantity. All components do not have to be accomplished; lessons may be ended at any time and resumed later.

## Instructional Plan: 60 minutes

### Subject

- Volume of Geometric Solids: Introduction to geometric vocabulary and the formula for finding the volume of right rectangular prisms

### Objective

- Students will be able to identify the elements of a right rectangular prism: edge, base, face, vertex.
- Students will apply their multiplication and addition skills to find the volume of a right rectangular prism with whole-number edge lengths.

### Materials

- blank paper (2 per student)
- pencil & crayons/colored pencils
- document camera or whiteboard
- right rectangular prism model or a rectangular Tissue box
- Optional:** printable “Exit Slip” (page 7)
- Optional:** printable “Volume Practice” (page 8)

Pass out 2 pieces of paper per student. One will be for “Notes” and the other for practice.

### Introduction

- T* Today we will explore one of the geometric solids, the right rectangular prism.
- T* Does anyone know what a rectangular prism is and can share with the class? **Call on students.**
- T* A great example of this would be a tissue box.
- T* Although some are shaped more like a cube, most tend to be shaped like a rectangular prism.
- T* We will start by identifying its elements, some of which you might already know.
- T* Then, we will move on to finding the volume of a right rectangular prism using whole numbers.

### Setting up Paper

- T* Write your name and date in the top right hand corner of your paper. **See example & model so students can follow.**
- T* On the top center of your paper, title it “Geometry.” **See example & model so students can follow.**
- T* Underneath your title write the statement, “I can identify the elements of a right rectangular prism and find its volume.” **See example & model so students can follow.**
- T* Below your “I can” statement, write “Vocabulary.” **See example & model so students can follow.**
- T* The first vocabulary word we need to know is “edge.”
- T* An edge is the side of a prism. **Point to the edges of the prism.**
- T* If you look at each side of the prism, what do you see? **Call on several students.**

Name & Date	
<b>Geometry</b>	
I can identify the elements of a right rectangular prism and find its volume.	
<b>Vocabulary:</b>	
<b>Edge:</b>	End of a side of a prism
<b>Face:</b>	Flat surface that makes one whole side of a prism
<b>Base:</b>	Bottom face of a prism
<b>Vertex:</b>	Corner where two or more edges meet

- T** Each flat square or rectangle that the prism has; is called a **face**.
- T** Let's add "face" to the vocabulary list.
- T** A face is the flat surface that makes one side of a prism.
- T** The next word in our list is going to be "base."
- T** Write down "base."
- T** Talk to the person next to you; what do you think is the difference between a "base" and a "face?"
- Call on several students. Answer:** The bottom face is called a "base." This is true not only for rectangular prisms, but for other solids as well.
- T** Underneath the definition of "base" you can write: "The bottom face of a prism."
- T** Finally, let's write down "vertex."
- T** We have already established what edges, faces, and bases are; let's think for a moment what a vertex might be. **Call on several students. Answer:** The corner where two or more edges meet.
- T** Let's write that definition down.
- T** A vertex is "the corner where two or more edges meet."
- T** Now that we have all the elements of a right rectangular prism, let's take a look at the model one more time: edge, face, base, and vertex. **Use either a model of a rectangular prism or a rectangular tissue box. Point to each of the vocabulary items corresponding to the model.**

Name & Date

**Geometry**

I can identify the elements of a right rectangular prism and find its volume.


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**Vocabulary:**  
**Edge:** End of a side of a prism  
**Face:** Flat surface that makes one whole side of a prism  
**Base:** Bottom face of a prism  
**Vertex:** Corner where two or more edges meet

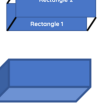
## Finding the Volume of a Rectangular Prism

- T** Moving on, let's consider our model and draw our own rectangular prism in our notes.
- T** Draw a line under your vocabulary words that we just defined and write, "Prism Volume" **Model this so that students can follow.**
- T** In order to draw a right rectangular prism, we will start by drawing a rectangle.
- T** Then, moving about a quarter of the way up our rectangle and over slightly to the right, we will draw a new rectangle.
- T** Last, we need to connect our corners by drawing 4 lines.
- T** We are now going to explore how to determine the volume of a rectangular prism.
- T** In order to do this, we need to know some measurements of this geometric solid.
- T** To find the volume, one must first know the measurements of the length, the width, and the height of the figure.
- T** Looking at the base of the prism, I can measure each edge.
- T** Let's begin by measuring our base.
- T** For the base, I will measure the length; we will measure across our prism in inches. **Point to the length of the prism model.**
- T** Let's say that the prism we have drawn is 3 inches in length. **Label the length of the prism you have drawn "3 inches".**
- T** Now we must determine the width of our prism in inches.
- T** Width means how wide an object is. **Point to the width of the prism model.**
- T** Let's say that the prisms' width is 2 inches wide. **Label the width of the prism you have drawn "2 inches".**

**Drawing a Rectangular Prism**

Step 1: 

Step 2: 

Step 3: 

Name & Date

**Geometry**

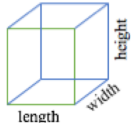
I can identify the elements of a right rectangular prism and find its volume.

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**Vocabulary:**  
**Edge:** End of a side of a prism  
**Face:** Flat surface that makes one whole side of a prism  
**Base:** Bottom face of a prism  
**Vertex:** Corner where two or more edges meet

---

**Prism Volume:**



$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

- T** Let's look at the edge that is going upward.
- T** Last, we need to determine the height of our prism. **Point to the height of the prism model.**
- T** Let's say the height of our prism is 4 inches. **Label the height of the prism you have drawn "4 inches".**
- T** Knowing the measurements of the edges, more specifically, the length, width, and the height will let us calculate the volume of the prism.
- T** On your paper, write down "Volume = length x width x height"
- T** Now let's see how we can apply these measurements to our formula to find the volume of our prism.
- T** Think about it for a moment and write down your ideas.

Name & Date \_\_\_\_\_

### Geometry

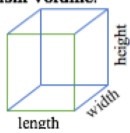
I can identify the elements of a right rectangular prism and find its volume.

---

**Vocabulary:**  
**Edge:** End of a side of a prism  
**Face:** Flat surface that makes one whole side of a prism  
**Base:** Bottom face of a prism  
**Vertex:** Corner where two or more edges meet

---

**Prism Volume:**



$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

**Give time to complete this task. Monitor students and provide assistance as needed.**

- T** What are your ideas for finding the volume of the prism? **Call on one or two students.**
- T** Do you agree or disagree with those ideas?
- T** Let's write these measurements down by following our formula of length x width x height.
- T** Using our formula we can calculate the volume in cubic units.
- T** Volume =  $3 \times 2 \times 4$ .  $V = 24$  cubic inches.
- T** The shorthand way to write this answer is:  $24 \text{ in}^3$
- T** Now let's think about that volume of 24 cubic inches.
- T** Do you think that two prisms that look different can have the same volume?
- T** Write down your ideas and show your work to prove how it either is or is not possible for them to have the same volume.

**Give time to complete this task. Monitor students and provide assistance as needed.**

**Call on several students to share their answers. Write different possibilities on the board.**

- T** Were you able to see that prisms with different lengths of their edges can have the same volume?
- T** This year we will only use whole numbers as the length of the different edges, but in sixth grade, you will be able to use fractions or decimals as well.
- T** Let's practice this with another example.
- T** With the person sitting next to you, I would like you to see if you could come up with 2 rectangular prisms that would have a volume of 84 cubic inches.

**Give time to complete this task. Monitor students and provide assistance as needed.**

- T** Who would like to share their answers? **Call on students. Possible Answers: 2, 6, 7 & 4, 3, 7 (Several other answers exist. Ensure that the product of the 3 numbers is 84)**
- T** You may have noticed that, your prior knowledge of fact families helped you to know that the order of multiplying the numbers doesn't change the product. The product is the answer to a multiplication equation.
- T** So, I can have a length of 2, a width of 6, and a height of 7, giving me a volume of 84 cubic inches.
- T** Or I could have a length of 7, a width of 2, and a height of 6, and the product or volume would still be 84 cubic inches.
- T** However, you would notice that visually the two rectangular prisms look different.
- T** Let's try one more practice independently this time!
- T** See if you can find two rectangular prisms with a volume of 72 cubic units.



Give time to complete this task. Monitor students and provide assistance as needed.

- T** Who would like to share their answers? Call on students. Possible Answers: 6, 3, 4 & 3, 3, 8 (Several other answers exist. Ensure that the product of the 3 numbers is 72)
- T** Who can tell me a strategy they used to help solve this problem that either worked or did not work? Call on students. They should explain what they did to try to solve the problem and justify why they believe it either worked or did not work.

### Differentiation:

For struggling students, you can try to give them 1 or 2 of the variables and see if they can find the other 1 or 2.

For example:

$$72 \text{ cubic units} = 6 \times \_\_ \times \_\_$$

$$\text{-or- } 6 \times 4 \times \_\_$$

Draw another right rectangular prism on the board and shade the base.

- T** Now let's investigate the formula for volume a little bit more.
- T** Write the formula  $V = l \times w \times h$ .
- T** Let's look at the first part, length times width.
- T** What does this remind you of? Call on one or two students.
- T** We can notice that the volume is equal to the surface area of the base times the height.
- T** So, let's write on the side that Volume = length x width x height and Volume = Base x height.
- T** Do you think that this rule can be applied to other solids as well? Let's explore.
- T** Let's think about a cylinder as the title of the next section.
- T** Let us draw a circle for a base of another solid, but this time we will not make a prism, but a cylinder. Model this step so students can follow along with your example. Shade the circle.
- T** What differences do you notice between a prism and a cylinder?
- T** Can we use the same formula for volume, Volume = length x width x height -or- Volume = base x height to determine the volume of a cylinder?
- T** Turn and talk about this with a partner sitting next to you, remember to defend your answer with explanations.

Name & Date \_\_\_\_\_

### Geometry

I can identify the elements of a right rectangular prism and find its volume.

**Vocabulary:**

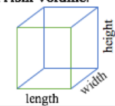
**Edge:** End of a side of a prism

**Face:** Flat surface that makes one whole side of a prism

**Base:** Bottom face of a prism


**Vertex:** Corner where two or more edges meet

**Prism Volume:**



Volume = length x width x height

**Cylinder Volume:**



Give time to complete this task. Monitor students and provide assistance as needed.

Call on several students to share their answers.

- T** It looks like we cannot determine the volume of a cylinder using the same formula because there are no "edges" for us to measure!
- T** If we wanted to find the volume of a cylinder we would need to use a different formula to determine the area of a circle, because a circle is the base of a cylinder.
- T** At the beginning of this lesson I told you that today we would be using a formula to determine the volume of rectangular prisms, so we will not be determining the volume of a cylinder today.
- T** What I would like to do is to have you practice a few more examples either independently or with a partner.
- T** After you finish these examples, you can create some of your own for a partner or another student in class to try to solve!



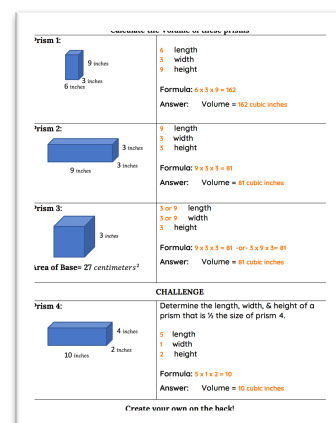
**On your feet/ Get ready to meet/ Go and Greet** (should take less than one minute)

- Students stand up and put their hand up in the air
- Students find another student that has their hand up to have a "new" partner (and get them moving around)
- Once they are with their new partner, they put their hands down and face the teacher

- T** Remember the units of a measurement are very important.
- T** Does anyone remember what units we were using earlier? **Call on students.**  
**Answer: cubic inches.**
- T** Please remember that when working with a partner both partners should be doing equal amounts of work.
- T** For problems like these, I would suggest trying to solve each first independently, and then share and discuss your answers.
- T** If we have time at the end, I will go over the answers with you as a whole class, otherwise I will collect your papers and leave them for your teacher to see your work!

Pass out printable volume practice (page 8) –or– project it for students to copy.

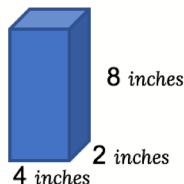
You may use the exit slip at the end of this lesson as a quick assessment of student understanding. Either print them out, or simply have students copy the problems on a half sheet of paper



Name: ANSWER KEY Date: \_\_\_\_\_

**Exit Slip:**

- 1) Determine the volume of the rectangular prism by identifying its length, width, and height.



- 4** length  
**2** width  
**8** height

**Formula:  $4 \times 2 \times 8 = 112$**

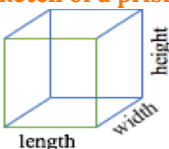
**Answer: Volume = 112 cubic inches**

- 2) Two right rectangular prisms have the same volume of 108 cubic inches.

- Draw two different possibilities and label the edges respectively so that the volume is the same.
- Plug in the numbers to check your answer.

**Answers will vary based on the number students select.**

**Sketch of a prism:**



**As long as the answers are factors of 108 and when multiplied give the correct volume, the student will receive full credit.**

**For example,  $108 = 4 \times 3 \times 9$ , so length = 4, width = 3, height = 9.**

**$108 = 2 \times 6 \times 9$ , so length = 2, width = 6, height = 9.**



**Make sure to “Break Up Your Day!”**



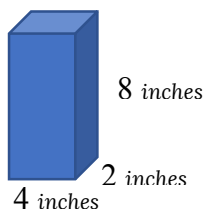
Now is a great time to take a break and get students re-energized.

See our list of engaging movement and brain break ideas to get your students moving and ready to refocus! (see page 9)

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Exit Slip:**

- 1) Determine the volume of the rectangular prism by identifying its length, width, and height.



\_\_\_\_\_ length

\_\_\_\_\_ width

\_\_\_\_\_ height

**Formula:** \_\_\_\_\_

**Answer:** Volume = \_\_\_\_\_

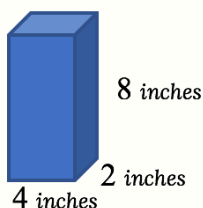
- 2) Two right rectangular prisms have the same volume of 108 cubic inches.

- a) Draw two different possibilities and label the edges respectively so that the volume is the same.  
b) Plug in the numbers to check your answer.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Exit Slip:**

- 1) Determine the volume of the rectangular prism by identifying its length, width, and height.



\_\_\_\_\_ length

\_\_\_\_\_ width

\_\_\_\_\_ height

**Formula:** \_\_\_\_\_

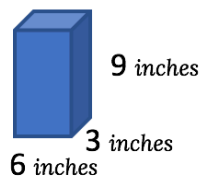
**Answer:** Volume = \_\_\_\_\_

- 2) Two right rectangular prisms have the same volume of 108 cubic inches.

- a) Draw two different possibilities and label the edges respectively so that the volume is the same.  
b) Plug in the numbers to check your answer.

**Calculate the Volume of these prisms**

**Prism 1:**



\_\_\_\_\_ length  
\_\_\_\_\_ width  
\_\_\_\_\_ height

Formula: \_\_\_\_\_

Answer: Volume = \_\_\_\_\_

**Prism 2:**

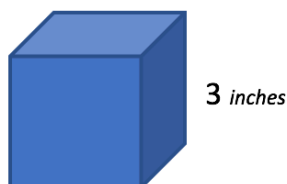


\_\_\_\_\_ length  
\_\_\_\_\_ width  
\_\_\_\_\_ height

Formula: \_\_\_\_\_

Answer: Volume = \_\_\_\_\_

**Prism 3:**



\_\_\_\_\_ length  
\_\_\_\_\_ width  
\_\_\_\_\_ height

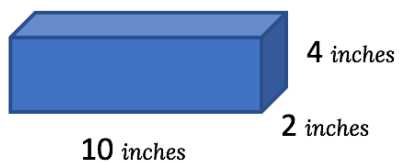
Formula: \_\_\_\_\_

Answer: Volume = \_\_\_\_\_

**Area of Base= 27 centimeters<sup>2</sup>**

**CHALLENGE**

**Prism 4:**



Determine the length, width, & height of a prism that is  $\frac{1}{2}$  the size of prism 4.

\_\_\_\_\_ length  
\_\_\_\_\_ width  
\_\_\_\_\_ height

Formula: \_\_\_\_\_

Answer: Volume = \_\_\_\_\_

**Create your own on the back!**

## Make sure to “Break Up Your Day!”

These can be used in the middle of a lesson or at the end of your lesson.

Here are a few engaging movement and brain break ideas to get your students moving and ready to refocus!



### Break Up Your Day: Math Outside!



- Students take scratch paper/pencil and find multiplication problems outside.
- Students write multiplication problems they see on the playground. (examples: 3 basketball courts times 6 students equals 18 basketball players, four hopscotches times 5 students equals 20 students playing hopscotch.)



### Break Up Your Day: Thumbs Up!



- Student is called on (use name cards or equity cards if available) to state a rounding observation from within the classroom using numbers from 1 to 500.
- Other students signify whether they understand and agree with the observation. (Example: “There are approximately 100 pencils in the classroom because each student has 3 pencils and there are 32 students. 3 times 32 is 96 and 96 rounds to 100.)
- Tally how many students agree with the rounding statements.
- The statement with the most votes or Thumbs Up is the “Round Up Captain”!



### Break Up Your Day: Body Stretches!



**10 minutes**

**FORMATION:** Standing at desks

- Have students begin the day with a series of simple activities lasting 30 seconds or more: jumping jacks, knee lifts, flap arms like a bird, hopping, scissors (feet apart then cross in front, feet apart then cross in back)...
- Follow each activity with a basic stretching movement:
- Reach for the sky runner’s stretch
- Butterfly stretch (sit with bottom of feet together)
- Knee to chest, rotate ankles, scratch your back

Hold stretches for 10 - 30 seconds. Repeat a different simple activity followed by a new basic stretch as many times as desired.