

## MA.5.GR.3.1

**Overarching Standard:** *MA.5.GR.3 Solve problems involving the volume of right rectangular prisms.*

### Benchmark of Focus

MA.5.GR.3.1 Explore volume as an attribute of three-dimensional figures by packing them with unit cubes without gaps. Find the volume of a right rectangular prism with whole-number side lengths by counting unit cubes.

### Benchmark Clarifications:

*Clarification 1:* Instruction emphasizes the conceptual understanding that volume is an attribute that can be measured for a three-dimensional figure. The measurement unit for volume is the volume of a unit cube, which is a cube with edge length of 1 unit.

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### Related Benchmark/Horizontal Alignment

- MA.5.NSO.2.1

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### Vertical Alignment

#### Previous Benchmarks

MA.3.GR.2.1

#### Next Benchmarks

MA.6.GR.2.3

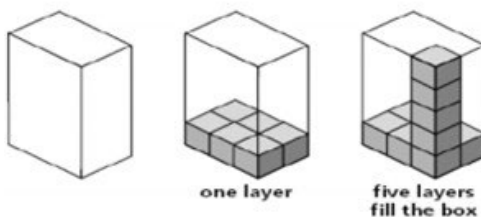
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### Purpose and Instructional Strategies

This benchmark introduces volume to students. Their prior experiences with volume were restricted to liquid volume (also called capacity). The concept of volume should be extended from the understanding of area starting in Grade 3 (MA.3.GR.2.1), with the idea that a layer (such as the bottom of cube) can be built up by adding more layers of unit cubes. In Grade 6, (MA.6.GR.2.3) students solve volume problems involving rectangular prisms with fraction and decimal side lengths.

- As students develop their understanding of volume, they recognize that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. This cube has a length of 1 unit, a width of 1 unit and a height of 1 unit and is called a cubic unit. This cubic unit is written with an exponent of 3 (e.g.,  $\text{in}^3$ ,  $\text{m}^3$ ). Students connect this notation to their understanding of powers of 10 in our place value system (K12.MTR.5.1).

Example:



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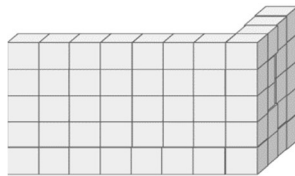
### Common Misconceptions or Errors

- Students may incorrectly fill figures to find volume with cubes. Students need to ensure there is no empty space included and that unit cubes are equally-sized and packed tightly in without overlaps.

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### Strategies to Support Tiered Instruction

- Instruction includes providing unit cubes and having students build rectangular prisms with specific dimensions and then calculating the volume.
  - For example, the teacher provides students with unit cubes and the following dimensions: length is 8 units, width is 4 units, and height is 5 units. Students stack equally sized unit cubes and ensure that the cubes are packed tightly with no gaps or overlaps to create a solid three-dimensional figure. Students begin building the figure as shown below, continuing to fill it in until complete. Students calculate the volume by multiplying  $8 \times 4 \times 5$  and then decompose the figure and count the cubes to determine if their calculation is correct.



- Instruction includes providing rectangular prisms filled with cubes. Some are filled correctly with no gaps or overlaps, and others have the cubes filling the rectangular prism, but with gaps left between them. Students identify which are stacked correctly to find volume and which are not stacked correctly and record the dimensions of the number of cubes for the height, length, and width, counting the total to determine the volume.

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### Questions to ask Students:

- *How can you use cubes to find the volume?*
  - Sample answer that indicates understanding: Take cubes of the same size like centimeter cubes and fill the rectangular prism without having any gaps. Count all of the cubes that it took to fill up the prism.
  - Sample answer that indicates an incomplete understanding or a misconception. Take cubes and fill the prism to the top.
- *How could you find the volume with cubes if you only have enough cubes to cover the bottom of the box?*
  - Sample answer that indicates understanding: Use the cubes to fill the bottom layer of the prism without any gaps or overlapping cubes. Count all of the cubes used in the bottom layer. Take some of the cubes you used on the bottom to stack them up on one of the cubes to get to the top and count how many layers of cubes you would need to fill the prism to the top.
  - Sample answer that indicates an incomplete understanding or a misconception: You can't really solve the problem because you don't have enough cubes but you could use the cubes to fill the bottom of the box and count them and then estimate how many more cubes would be needed to fill the box.

- For example: Top View of Rectangular Prism



Student's explanation: There are 3 rows of 14 cubes in the bottom layer so there are 42 cubes on the first layer. It takes a total of 4 cubes to reach the top of the prism so there are 4 layers or 4 groups of 42 cubes.  $4 \times 42 = 168$  so the volume is 168 cubic units.

- Sample answer that indicates an incomplete understanding or a misconception: You can't really solve the problem because you don't have enough cubes but you could use the cubes to fill the bottom of the box and count them and then estimate how many more cubes would be needed to fill the box.

## Instructional Tasks

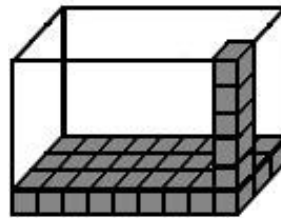
### *Instructional Task 1*

Molly is putting her cube-shaped blocks into their storage container after she finishes playing with her sister. The storage container is shaped like a right rectangular prism and she has a total of 120 blocks. The bottom layer of her storage container holds exactly 6 rows of 4 blocks each with no gaps or overlaps. The storage container holds exactly 6 layers of blocks with no gaps or overlaps. Part A. Will all of Molly's blocks fit in the storage container? Explain how you know using drawings and equations. Part B. If there is enough room, determine how many more blocks Molly could fit in the storage container. If there is not enough room, determine how many blocks will not fit be able to fit in the storage container.

## Instructional Items

### *Instructional Item 1*

What is the volume of the right rectangular prism?



## Achievement Level Descriptors

Benchmark	Context	Assessment Limits
MA.5.GR.3.1 Explore volume as an attribute of three-dimensional figures by packing them with unit cubes without gaps. Find the volume of a right rectangular prism with whole-number side lengths by counting unit cubes. Clarification 1: Instruction emphasizes the conceptual understanding that volume is an	Both	Figures may only be shown with unit cubes. Items requiring measurement of volume by counting unit cubes must provide a key of the cubic unit. Items must contain a graphic of the

attribute that can be measured for a three dimensional figure. The measurement unit for volume is the volume of a unit cube, which is a cube with edge length of 1 unit			figure. Measuring units will not have exponents (cm <sup>3</sup> , etc.).
ALD 2	ALD 3	ALD 4	ALD 5
Explores volume as an attribute of three-dimensional figures by packing them with unit cubes without gaps; finds the volume of a right rectangular prism with whole-number side lengths not greater than 3 by counting unit cubes	Explores volume as an attribute of three-dimensional figures by packing them with unit cubes without gaps; finds the volume of a right rectangular prism with whole-number side lengths not greater than 5 by counting unit cubes.	Explores volume as an attribute of three-dimensional figures by packing them with unit cubes without gaps; finds the volume of a right rectangular prism with whole-number side lengths by counting unit cubes	Finds the volume of a right rectangular prism counting unit cubes where all unit cubes are not present/shown.

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**Additional Resources:**

CPALMS [MA.5.GR.3.1 - Explore volume as an attribute of three-dimensional figures by packing them with unit cubes without gaps. Find the volume of a right rectangular prism with whole-number side lengths by counting unit cubes. \(cpalms.org\)](#)

Video Game Store: Volume! [Video Game Store: Volume! Help solve the problem of shipping video games and accessories to customer ... \(cpalms.org\)](#)

Volume of Rectangular Prisms

<http://www.shodor.org/interactivate/lessons/VolumeRectangular/>

Khan Academy: [Measuring Volume with Unit Cubes](#)

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**Resources/Tasks to Support Your Child at Home:**

LearnZillion: Understanding Volume

[https://learnzillion.com/lesson\\_plans/9043-understanding-volume](https://learnzillion.com/lesson_plans/9043-understanding-volume)