

Core Content

Cluster Title: Geometric measurement—understand concepts of volume and relate volume to multiplication and to addition.

Standard 5: Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

- a) Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes (e.g., to represent the associative property of multiplication).
- b) Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.
- c) Recognize volumes as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.

MASTERY Patterns of Reasoning:

Conceptual:

Students understand the mathematical operation for determining volume in a right rectangular prism using whole numbers.

Students understand real-world situations by recognizing that volume is the number of cubic units needed to fill a solid figure.

Students understand the volume of two or more solid figures added together equals the composite volume of the complete figure. (The sum of the parts equal to the whole.)

Procedural:

Students can pack a right rectangular prism with unit cubes and discover the numerical representation for the volume using the associative property of multiplication.

Students can explain how to relate counting cubes to the formula for finding volume.

Students can formulate separate volumes of various rectangular prisms and add shapes/volumes of the complete figure.

Representational:

Students can discover the threefold (three edge lengths) whole-number products as volume.
 Students can apply the formulas $V = l \times w \times h$ and $V = b \times h$.
 Students can separate the shape into rectangular prisms to find volume.

Supports for Teachers

Critical Background Knowledge

Conceptual:

Students will understand the associative property of multiplication with three whole numbers.
 Students will have knowledge of attributes of solid figures.
 Students will understand a cubic unit.
 Students know and understand measurement and various cubic units.

Procedural:

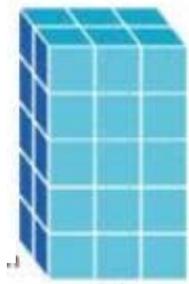
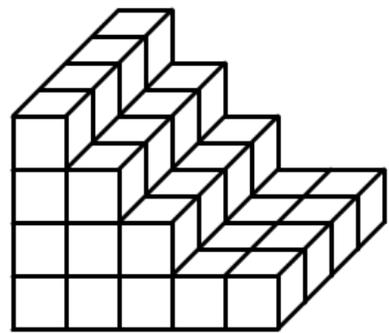
Students can demonstrate the ability to pack a right rectangular prism with unit cubes without overlap or gaps.

Representational:

Students can demonstrate an understanding of the three dimensions of a rectangular prism.

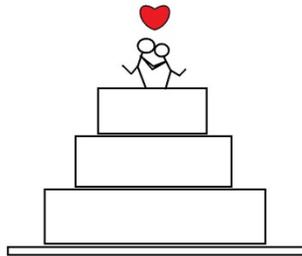
Academic Vocabulary and Notation

base/area of base, length, right rectangular prism, edge, height, formula, abbreviations of measurements (l , w , h , b , V),
 depth, additive

| Instructional Strategies Used | Resources Used |
|--|----------------|
| <p data-bbox="178 235 1113 267">Find the volume of this shape. Record your answer in cubic units.</p> <div data-bbox="556 308 745 592" style="text-align: center;">  </div> <p data-bbox="178 738 798 771">What is the volume of this stack of blocks?</p> <p data-bbox="178 812 514 844">Answer: 44 cubic units</p> <div data-bbox="430 958 819 1291" style="text-align: center;">  </div> | |

Dillan made a wedding cake with three layers.
 The bottom layer: $b = 64 \text{ inches}^2$ $h = 2 \text{ inches}$
 The middle layer: $b = 36 \text{ inches}^2$ $h = 2 \text{ inches}$
 The top layer: $b = 16 \text{ inches}^2$ $h = 2 \text{ inches}$
 What is the total volume of the cake?

Answer: 232 cubic inches



Assessment Tasks Used

Skill-Based Task:

Show a drawing of a stacked right rectangular prism. Students will find the length, width and height of the figure and calculate the volume.

Use appropriate vocabulary words to explain how to compute volume.

Accurately compute volume of solid figures composed of two non-overlapping rectangular prisms.

Problem Task:

Matthew has a treasure box with a base of 12 inches by 4 inches. The height is 8 inches. What is the volume of his treasure box?

A fifth grade class has a fish tank that is 26 inches long, 1 foot wide, and 16 inches deep. What volume of water can the tank hold?

The city swimming pool has a base area of 100 ft^2 and a depth of 12 ft. Find the volume of the pool.