

**My Notes** 

## Volume Crystal Collections Lesson 26-1 Volume of Cubes

## **Learning Targets:**

- Find the volume of a right rectangular prism with fractional edge lengths.
- Write equations that represent problems related to the volume of right rectangular prisms.

**SUGGESTED LEARNING STRATEGIES:** Close Reading, Paraphrase, Think Aloud, Visualization, Vocabulary Organizer, Construct Arguments, Create a Plan, Use Manipulatives, Look for a Pattern

Crystals are solids formed by a regular repeated pattern of molecules connecting together. They have a regular shape and flat sides. Some crystals form cubes while others grow into columns with three or more sides. The figures shown below are crystals.







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The collected atoms that make up crystals are called unit cells. They are the simplest repeating unit in the crystal and are repeated in exactly the same arrangement throughout the solid. Opposite faces of a unit cell are parallel. A simple cubic unit cell is in the shape of a cube.

Cubes are named for the lengths of their edges:

- A 1-inch cube is a cube with edges that are 1 inch in length.
- A 2-inch cube is a cube with edges that are 2 inches in length.
- A  $\frac{1}{2}$ -inch cube is a cube with edges that are  $\frac{1}{2}$  inch in length.
- Any size cube can be used to build larger cubes.

**Volume** is a measure of the amount of space a solid occupies. It is measured in cubic units, such as cubic inches (in.<sup>3</sup>), cubic feet (ft<sup>3</sup>), cubic centimeters (cm<sup>3</sup>), or cubic meters (m<sup>3</sup>).

One way to find the volume of a solid is to fill the solid with cubes. The volume is the total number of cubes needed to fill the solid.



The cube in the diagram is an *a*-unit cube. Each edge is *a* units long.



- **1.** Halite, or table salt, is a mineral that is made up of cubic crystals. Use unit cubes, provided by your teacher, as models of 1-inch cubes.
  - **a.** Use the unit cubes to build models of 2-inch and 3-inch cubes. Then complete the table.

Length of Edge (in.)	Area of Face (in.²)	Volume of Cube (in. <sup>3</sup> )
1		
2		
3		

- **b.** Describe any patterns you see in the table.
- **2. Make use of structure.** Describe how you can use the patterns you found in the table to determine the volume of a cube when you do not have enough unit cubes to build the cube.
- **3.** Let the variable *e* represent the length of the edge of a cube. Write a rule for finding the volume, *V*, of a cube in terms of the length of an edge, *e*.
- 4. Model with mathematics. Cut out the nets of cubes, Figure 1 and Figure 2, on page 341.a. Fold each figure to form a cube.
  - **b.** How many of the smaller cubes made from Figure 1 will fit into the larger cube made from Figure 2?
  - **c.** Look back at the table in Item 1. How many cubes with edge length 1 inch will fit into the cube with edge length 2 inches?

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**5.** Consider a cube with edge length 4 inches. How many of these smaller cubes will fit into an 8-inch cube? Explain your thinking.



In Items 4 and 5, the ratio of the edge length of the smaller cube to the edge length of the larger cube is  $\frac{1}{2}$ .

The rule you determined earlier in the activity to find the volume of a cube can also be used to find the volume of a cube with fractional edge lengths.

- 6. Find the volume of each cube with the given edge length. a.  $\frac{2}{3}$  foot
  - **b.**  $1\frac{1}{4}$  inches
- **7.** A storage shed shaped like a cube has sides that are 3.5 meters long. What is the volume of the storage shed?



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## **Check Your Understanding**

- **8.** A cube has an edge length of 5 centimeters. What is the volume of the cube?
- **9.** What is the volume of a cube with an edge length of  $\frac{1}{6}$  foot?

## **LESSON 26-1 PRACTICE**

For Items 10–13, find the volume of each cube.



- **14.** A cube has an edge length of 4.3 meters. What is the volume of the cube?
- **15.** What is the volume of a cube with an edge length of  $\frac{1}{4}$  yard?
- **16.** A cube has a volume of 1,000 cubic feet. What is the edge length of the cube?
- **17.** The area of one face of a cube is 36 cubic inches. What is the volume of the cube?
- **18.** How much greater is the volume of a cube with edges that are  $2\frac{1}{2}$  feet long than a cube with edges that are 2 feet long?
- **19.** A fish tank shaped like a cube has sides that are 9 inches long. What is the volume of the fish tank?
- **20. Reason quantitatively.** A cube has a surface area of 96 square inches. What is the volume of the cube? Explain your thinking.
- **21. Make sense of problems.** A tower is made from three cubes stacked on top of each other. The edges of the cubes are 4 inches, 6 inches, and 8 inches. What is the total volume of the tower?