

Volume – A Solid Measurement

Purpose

Students will find the volume of rectangular solids using appropriate units.

Materials

For the teacher: 24 interlocking cubes, shoebox, scissors, example of a rectangular solid, chalk, chalkboard

For each student: 24 interlocking cubes, metric ruler, copy of Black Line Master (BLM) *Volume – A Solid Measurement*

For every 4 or 5 students: 4 solid rectangular objects marked “A,” “B,” “C,” and “D”

Activity

A. Introduction

1. Show students the shoebox. Ask students to tell you the size of the shoebox. Discuss the possible meanings of size (e.g., weight, surface area, height, etc.).
2. Tell students that they will be learning another way to determine the size of a rectangular solid.
3. Review the meaning of area (and surface area, if it has been taught). Explain that volume measures not only the outside of an object, but also the total amount of space the object occupies.
4. Cut apart the shoebox so that it can be flattened. Explain to the students that the *area* (or *surface area*) of the shoebox is represented by the flattened cardboard.
5. Fold the shoebox back into its original shape and show the empty inside to the students. Tell them that *volume* measures the empty space inside the shoebox.
6. Show the class the rectangular solid and explain that it might be easier to understand the meaning of volume by looking at a solid object. The space the solid occupies *including* the inside of the solid determines the volume.

B. Student Activity

1. Give each student 24 interlocking cubes, a copy of the BLM *Volume – A Solid Measurement*, and a metric ruler.
2. Hold one interlocking cube up and explain that each cube measures 1 centimeter wide, 1 centimeter high, and 1 centimeter long. Have students measure the sides to confirm.

(continued)

EXTENDING
THE



ACTIVITY

Explain to students the simplicity of conversion between capacity and volume in the metric system. Tell them that a cubic centimeter is the same measure as a milliliter. Compare to English units of capacity and volume.

MEETING
INDIVIDUAL



NEEDS

Have students who have difficulty connecting volume to area take apart their rectangular solids. Have them divide the $2 \times 3 \times 3$ solid into three 2×3 panels to see why the volume formula applies.

Standards Links
5.2.1, 5.3.2, 5.4.8

Activity (continued)

3. Explain that while *area* measures two-dimensional objects in square units, *volume* measures three-dimensional objects in cubic units. Tell the students that one unit cube measures one cubic centimeter, two interlocking cubes measure two cubic centimeters, etc.
4. Have students create a rectangular solid that is three cubes long, two cubes wide, and three cubes high. Have them determine the number of cubes that they used by subtracting the loose cubes from 24.
5. Draw the outline of a solid object on the chalkboard similar to the first one on the BLM.
6. As a class, work together to fill in the answers to the first task on the BLM. Measure the sides of the prism to confirm the measurements.
7. Have students continue to construct the next two solids with the blocks and fill in the answers that correspond to their constructions. Explain that not all rectangular solids are constructed with interlocking cubes. Tell students to be looking for a clue to an easier way to find the volume than counting the number of interlocking cubes.
8. When students have discovered the formula for volume of a rectangular solid, write it on the chalkboard: "Volume = length \times width \times height." Remind students to use the appropriate units [cubic centimeters] for their construction.


C. Group Activity

1. Divide the students into groups of four or five.
2. Give each group four rectangular solid objects.
3. Have each student measure each of his/her group's objects to find the volume of the objects. Instruct students to write their measurements in the appropriate places on the BLM. Tell students to compare their measurements with other members of the group and investigate any answers that do not match.

Questions for Review

Basic Concepts and Processes

During the Student and Group Activities, ask the following questions:

 What is the volume of a rectangular object that is one inch long, three inches wide, and three inches high?



How did you find the volume?



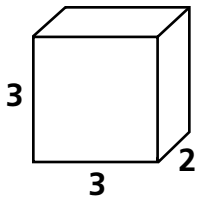
What units is the volume of the object in?

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Fill in the answers below while constructing rectangular solids during the activity.

1. Construct a rectangular solid that measures:

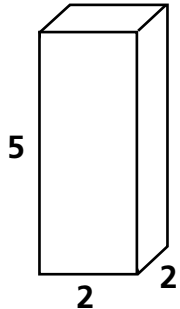
3 cubes long
2 cubes wide
3 cubes high



How many cubic centimeter blocks did you use? _____

2. Construct a rectangular solid that measures:

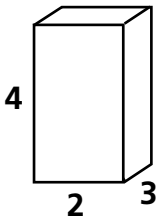
2 cubes long
2 cubes wide
5 cubes high



How many cubic centimeter blocks did you use? _____

3. Construct a rectangular solid that measures:

2 cubes long
3 cubes wide
4 cubes high



How many cubic centimeter blocks did you use? _____

Look at the number of cubic centimeters (volume) of each rectangular solid. Think about how it relates to the measurements of the sides.

Write the formula for Volume of a rectangular solid below:

Volume = _____ × _____ × _____

Measure the objects assigned to your group. Answer the questions about each object.

Object A

Length = _____

Width = _____

Height = _____

Volume = _____

Object B

Length = _____

Width = _____

Height = _____

Volume = _____

Object C

Length = _____

Width = _____

Height = _____

Volume = _____

Object D

Length = _____

Width = _____

Height = _____

Volume = _____

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Teacher Directions

Distribute one copy of the BLM *Volume – A Solid Measurement* to each student. Have students complete the first three problems by constructing with unifix cubes the rectangular solids of the sizes indicated and writing down the number of cubes used. Complete the first construction as a class and have students work on the other two independently. Work together to determine the formula for the volume of a rectangular solid.

Have students work in groups on the last four problems. Have them measure rectangular solids in centimeters, write down the measurements, and use the formula to determine the volume. Have students discuss their calculations as a group to determine any inconsistent answers and correct them. Instruct students to use correct unit measures (cubic centimeters).

Answer Key

1. 18 cubic centimeters
2. 20 cubic centimeters
3. 24 cubic centimeters

Volume = length \times width \times height

The answers to the group project will vary.