



Drexel-SDP GK-12 ACTIVITY

Measuring Volume

Subject Area(s) Measurement

Associated Unit

Associated Lesson

Activity Title Measuring Volume

Grade Level 5

Time Required 1.5 hrs

Group Size 3

Expendable Cost per Group \$0.90 (depending upon cost of juice boxes)

Summary

This lesson allows students to measure the volume of pre-packaged liquids. Students can examine a variety of package shapes and sizes. The dimensions of the packages are measured and volume is calculated. The students develop a hypothesis regarding which container has the most juice and use measurements to determine the truth.

Engineering Connection

There are several methods of measuring volume of a substance such as displacement or calibrated cylinders. For example, civil engineers may want to measure the amount of sediment collected over a period of time through a culvert. In doing so, they may choose to use the displacement method to see how much water the solid matter displaces. Likewise, if she were designing a water storage tower, she'd need to know the volume of water to be stored.

Keywords

Volume

PA Educational Standards

- Science:

- 3.2.4 Inquiry and Design
- Math:
 - 2.3.5 Measurement and Estimation
 - 2.4.5 Mathematical Reasoning and Connections
 - 2.5.5 Mathematical Problem Solving and Communication
 - 2.6.5 Statistics and Data Analysis

Pre-Requisite Knowledge

None but previous experience with measuring volume is helpful

Learning Objectives

After this lesson, students should be able to:

- Measure the volume of a liquid
- Calculate the volume of a 3D object
- Understand how engineers determine the size of container needed for storage.

Materials List

Each group needs:

- 2 Juice containers of equal size. One should be a soft packaging and the other should be a firm rectangular prism package.
- One beaker
- Tape measure or ruler

To share with the entire class:

- Tape measure or ruler

Introduction / Motivation

Measuring materials is a task routinely used in engineering. The materials can be liquids, solids, or even gasses. Civil engineers design large towers to store water. These towers can be seen around towns and along highways. The towers are designed to hold a certain amount of water. The amount of water the tower can hold is the volume of the container. The dimensions of the tower itself determine this amount.

Industrial engineers play an important role in the manufacturing and packaging of materials for sale. Part of their job is to figure out what type of material is the most efficient for storing and transporting their product. Packages can be made from paper, plastic, metal, or other substances. The amount and cost of the packaging material are factors that they use when figuring out which to use.

In this lab you will practice measuring the volume of liquids. Two containers, of different material, will be examined and measured. The volume of liquid will be measured and calculated. You will examine the different materials used in packaging and think about why an engineer might have selected each one.

Vocabulary / Definitions

Word	Definition
Volume	The amount of space enclosed in a space (3-dimensional figure) measured in cubic units.

Procedure

Before the Activity

- Gather the following materials per group:
 - 2 juice boxes
 - 1 tape measure or ruler
 - 2 beakers
 - Optional: pan to minimize spills, paper towels

With the Students

- Discuss the formula for measuring volume: $\text{Length} \times \text{Width} \times \text{Height}$. Write this formula on the board or somewhere the students can refer back to it.
- Ask students which container they believe can hold the greater amount of liquid.
- Ask students to brainstorm when they think an engineer would have to use containers. When this is complete have the students write their hypothesis on the worksheet.
- Ask students to take the measurements, length, width, and height, of both containers and calculate the volume of each container. Record the data in the data table.
- Ask students to pour the contents of each container into separate beakers.
- Have students measure each beaker and record the values into their data table.
- Ask students to draw a conclusion regarding which container holds more liquid.
- As a class, analyze the data and discuss the conclusion. Guide students to see that the containers held equal volumes of juice. Discuss the difference in shape and size note that this does not affect the volume. Optional: Discuss the reasons for the difference in package material, size, shape although they both contain equal volumes of liquid. This would be important to engineers such as materials engineers and industrial engineers.

Attachments

Measuring Volume Worksheet

Troubleshooting Tips

Depending upon the accuracy of the beakers and the amount of liquid spilled while pouring, the measured volume, calculated volume and manufactured volume may differ slightly. If this occurs discuss the possible causes of the disparity with the students.

Investigating Questions

Why does one package appear to contain more liquid than the other? Students may believe the software package contains more liquid because it is taller than the rectangular package. This height difference is easy to see. Recalling the volume formula, $\text{Length} \times \text{Width} \times \text{Height}$, the taller package is either not as long and/or wide as the rectangular package. Students may not consider the difference in all three dimensions when making their hypothesis.

Assessment

Pre-Activity Assessment

Class Discussion:

- Remind students of the formula for volume if they have already covered the topic.
- Talk with students about different methods of measuring volume of solids, liquids, and gasses.
- Ask the students to make a hypothesis about which container holds more liquid.

Activity Embedded Assessment

- Have students fill out the lab handout. Review the accuracy of their measurements and calculations.

Post-Activity Assessment

- Ask students to draw a conclusion about which container held more liquid. Students should be able to look at the completed table and determine that the containers held equal amounts. Ask students to evaluate their hypothesis based upon their data.
- Ask students to think about and discuss why different materials may have been used to package the same amount of liquid.
- Discuss with students ways of comparing the two containers' measurements to determine that they have equal volumes although they may not look like it. This will test their understanding of the multiple dimensions (length, width, height) involved in measuring volume.

Owner

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Contributors

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Measuring Volume Student Worksheet

Name: _____

Date: _____

Key Formula – Volume = Length x Width * Height

Investigating Question: Which container holds the largest amount of liquid?

Hypothesis: I believe that.....

Materials:

Beaker, 2 juice containers, tape measure

Procedure:

- 1) Using tape measure record the measurements of each container. Use the volume formula to calculate the volume of each container and record the values in the table.

	Rectangular Box	Soft Package
Length		
Height		
Width		
Calculated Volume		

- 2) Pour the contents of each container into a beaker and measure the volume of liquid. Record the measurements in the table below.

	Rectangular Box	Soft Package
Measured Volume		