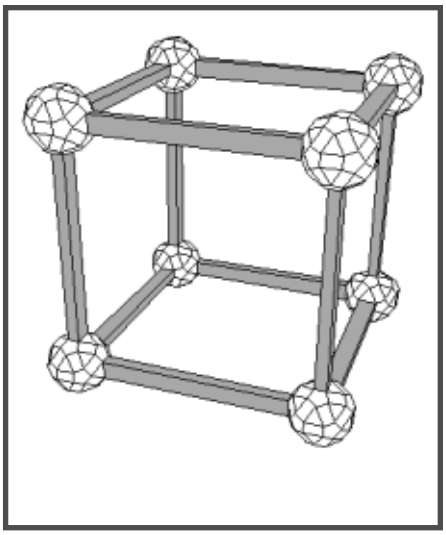
Zome System

*Builds Genius!*

# Volume for Beginners

## Mathematics
## Basic Concept

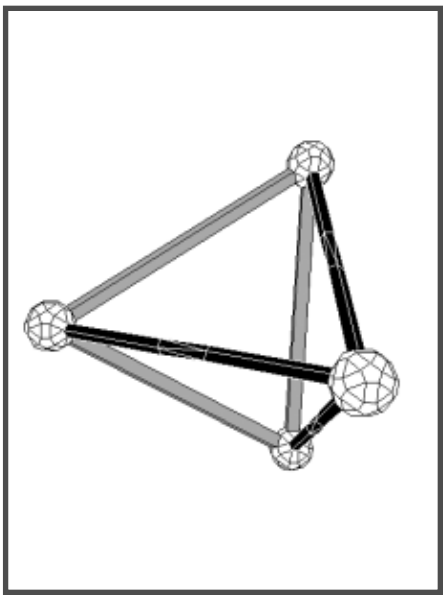
Lesson Objective:
Introduction to the concept of volume for younger students, who have not learned multiplication. At this age, volume is not going to be an exact measurement. Exploration and problem solving is more important at this point.



Prerequisite Skills:
Students need to have played with Zome System before, know basic geometric shapes ("Geometric Shapes," and "Geometry is All Around Us", and be familiar with concepts of area ("What is Area?").

Time Needed:
One class period of 45-60 minutes.

Materials Needed:
- Two Zome System Creator Kits for 25-30 students
- Large bag of dried lima beans, styrofoam peanuts, or similar objects.

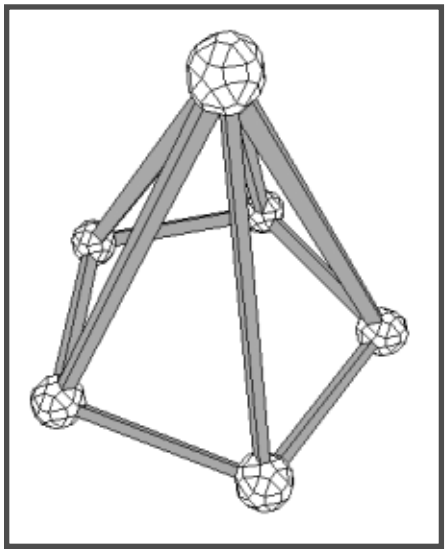


Procedure:
Explain to the students that they are going to start working on something called volume. *Does anyone know what that word means?*

Divide the class into teams of 2-3 students, and distribute the Zome System pieces. The first task for the teams is to build a small "box". The box can be made up of any of the polygons they already know. Cubes, pyramids, various prisms, etc., are all acceptable. Allow 10 minutes for the teams to agree on the shape of the box, and complete building it.

Now explain that volume is a measurement of how much *can be fitted inside an object. How could we find the volume of an object? How would we describe the volume once we find*

*it?* Explain to the class that they will use lima beans as the unit to determine the volume of their box. Distribute the beans to the teams. The task for the teams is to figure out a method of measuring how many beans fit into the box. They must take notes of their discussions and different ideas.



Circulate and question the students as they experiment. Some teams are likely to use their hand to stop the beans from running out the sides of their box. Others may establish how many beans fit on the bottom of their structure, and then estimate how many layers would fit on top of each other. They will get an answer by repeated addition of the number of beans in the bottom. Repeated addition is of course the first step towards multiplication. Yet others will lay the structure on its side, and fill the sides with beans. This way they will be able to get an exact count of the layers.

Break off the exploration after 15 minutes, or when all teams have an answer. Each team should introduce their structure to the class, relate how many beans it can contain, and explain how they came to *this answer.*

*Discuss what the teams learned. Was the exercise difficult? Why, or why not? Which structure had the largest volume? Which had the smallest? Which method of measuring bean volume was the fastest? Which was the slowest. Which one was the most accurate? Would all the methods have worked if the structures were much bigger? Is there a quicker way to add up all the layers for those who counted layers? Which units of volume do the students know? In which situations do we need to know volumes?* Conclude by asking the students to individually write down some observations about volume and its uses.

Assessment:

Observe the students while they work in their teams, and question them on their findings. Review team and individual notes about volume. To meet the standard, students must devise a method to calculate the volume (in beans) of a simple structure. To exceed the standard, they must draw some conclusion on the need for a more standardized measuring unit.

Standards Addressed:

* Mathematics standards addressing geometry and spatial sense (NCTM Standard 9).
* Mathematics standards addressing measurement (NCTM Standard 10).

Transfer Possibilities:

Use of standard measurement units to determine volume. Introduction to multiplication. Study of the interaction between volume and area (“Measures of Space I-Lengths and Areas,” and “Measures of Space II-Volumes”).