

Topics: Digestion,
Volume & Surface Area

Materials List

- ✓ Wooden Cubes (192)
- ✓ Hot glue or white glue
- ✓ 3 zip-close plastic bags (small)

This activity can be used to teach:

Common Core Math Standards:

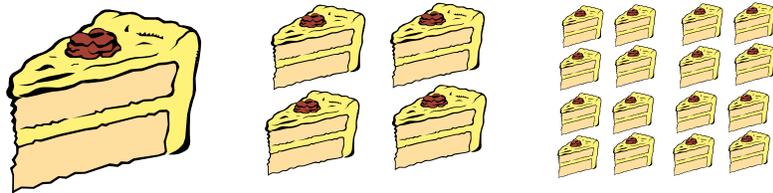
- Area and perimeter of rectangles (Grade 4, Measurement and Data, 3)
- Measure volume, solve problems involving volume (Measurement and Data, Grade 5, 3-5; Geometry, Grade 6, 2; Grade 7, 6),
- Evaluate expressions (Grade 6, Expressions and Equations, 2c)
- 2-Dimensional representations of 3-Dimensional objects (Grade 6, Geometry, 4)

Next Generation Science Standards:

- Body structures and systems (Life Science, Grade 1-1; Middle School, 1-3)

Chewed Food

A Quantitative Look at Surface Area



It would certainly be easier to just gulp our food whole, so why is it an advantage to spend all that time chewing?

Assembly

1. Glue together wooden cubes to create 1 large cube 4 units by 4 units by 4 units. Place this cube into a zip-close bag. Label this bag “Sample “A” -Whole piece of food”.
2. Create 8 smaller cubes 2 units by 2 units by 2 units. Place these cubes into their own zip-close bag. Label this bag “Sample “B” - Chewed Food”.
3. Place 64 single cubes into a 3rd zip-close bag. Label this bag “Sample “C” - Well-chewed food”.

To Do and Notice

1. Review formulas for volume ($L \times W \times H$) and surface area ($L \times W$ of each side added together).
2. Examine the cube samples in the bags. Each represents the same piece of food as it is being chewed into smaller pieces.
3. Calculate the volume and surface area of “Sample A”. Record the data.
4. Calculate the total volume and total surface area of “Sample B”. Record the data.
5. Calculate the total volume and total surface area of “Sample C”. Record the data.
6. Notice that while the volume stays the same, the surface area increases dramatically as the pieces are “chewed”.

The Science Behind the Activity

Chewing food serves 3 main purposes for humans: 1) It reduces the risk of choking on larger pieces of food. 2) It mixes the food with saliva, starting the digestion process. 3) It increases surface area of the food so that gastric juices (mucus, acids, and enzymes) in the stomach can break down food more quickly and efficiently. In this activity, students will qualitatively discover the importance of the 3rd purpose through measurement.

Students often confuse the concepts of volume and surface area or incorrectly think of the 2 measurements as the same. Many students are surprised when they do the math and see the dramatic increase in surface area when objects are broken down into smaller pieces.

Taking it Further

For other ideas using cubes to teach the concept of volume and 3-D space, see the RAFT Idea Sheets *Taking Up Space* and *Building Blocks*.

Web Resources (Visit www.raft.net/raft-idea?isid=34 for more resources!)

- Teacher designed math courses from the New Jersey Center for Teaching & Learning – <https://njctl.org/courses/math>