

Lesson Plan: Packing Sugar

MAFS.5.MD.3.3: Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

- A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume.
- A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.

MAFS.5.MD.3.4: Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

MAFS.5.MD.3.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

- Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.
- Apply the formulas $V = l \times w \times h$ and $V = B \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.
- Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

3 Act Task Format: Packing Sugar

Show the Act 1 video “Packing Sugar” to students. <https://gfletchy.com/packing-sugar/>

Ask students what they noticed mathematically in the video, what they wonder about mathematically, and what mathematical questions they have about what they saw in the video.

Give each student a copy of the Student Recording Sheet. Have students record their questions and curiosities in the Act 1 section that asks “What questions come to your mind?” Consider doing a think-pair-share so that students have an opportunity to talk with each other before sharing questions with the whole group. Students may need to watch the video several times.

- Share and record students’ questions. The teacher may need to guide students so that the questions generated are math-related.

1. What do you notice? What do you wonder?
2. How are the sugar cubes packed in the box? (dimensions)
3. What are some dimensions you know are not accurate?

During Act 2, <https://gfletchy.com/packing-sugar/> students review the main question from Act 1 and decide on the facts, tools, and other information needed to answer the question. The main question for this task is **How many sugar cubes are in the box?**

- Students can record information that they need to solve the problem, given information, estimates and work on the student recording sheet under Act 2.
- When students decide what they need to solve the problem, they should ask for those things. It is pivotal to the problem solving process that students decide what is needed without being given the information up front.

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This material accompanies a videotaped lesson on Inside Mathematics (www.insidemathematics.org): Calculating Volume of Rectangular Prisms: Public Lesson. Austin, Texas: the Charles A. Dana Center at The University of Texas at Austin.

- The teacher provides guidance as needed during this phase. Some groups might need scaffolds to guide them. The teacher should question groups who seem to be moving in the wrong direction or might not know where to begin.

Questioning is an effective strategy that can be used, with questions such as:

- What is the problem you are trying to solve?
- What do you think affects the situation?
- Can you explain what you've done so far?
- What strategies are you using?
- What assumptions are you making?
- What tools or models may help you?
- Why is that true?
- Does that make sense?
- How can we use this to find the amount of sugar cubes?
- How can we use the height of the unit cube to discover the height of the box?

During Act 3- Students will collaboratively, in groups of 3-4 will try and figure out how this student found the volume of the box. Whole Group – Share solutions and strategies.

- Students present their solutions and thinking and compare them.
- Reveal the solution by showing the Act 3 photograph: <https://e2t2dwn1mz-flywheel.netdna-ssl.com/wp-content/uploads/2016/02/screen-shot-2016-02-14-at-10-34-24-am.png>
- Lead discussion to compare these, asking questions such as:
 - Which strategy was most efficient?
 - Can you think of another method that might have worked?
 - What might you do differently next time?