ITEM DESCRIPTION

Grade: 6	**Content area:** MATH	**Item Type:** PT
	Difficulty: (B, P, A) A	**DOK: (Webb 1- 4) 3**
Unit of Study: Unit 2 - Operating with Positive Rational Numbers		

Content Standard(s)
6.G.2. Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

Practice Standards
MP.1. Make sense of problems and persevere in solving them.
MP.5. Use appropriate tools strategically.
MP.7. Look for and make use of structure. (In this task, it is the structure of the geometric solids that may support students' thinking.)

Source: CT State Department of Education

ITEM DETAILS

Pre-Assessment and/or Instructional Performance Task

Item Stem

Mike is using cubes that measure $\frac{1}{2}in$ on each side to fill a box that has a height of $2\frac{1}{2}in$, width of 2 *in*, and length of $1\frac{1}{2}in$.

How many $\frac{1}{2}in$ cubes will Mike need to fill the box?

Instructional Tips

Ask students to create a plan for solving this problem. What resources would help them? How can they model the problem (if necessary)? Provide time for students to plan, asking them only to brainstorm strategies, but not yet work on the solution. [NOTE: Students should still be encouraged to try strategies that seem ineffective or inefficient and analyze these as they work through them. We often learn more from what we do wrong five times than what we do right once.]

As a pre-assessment, it is more important to examine the approaches students are taking to the problem to monitor changes in their approaches from pre- to post-assessment.

- Do some students already know the formula V=lwh? If so, are they able to

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apply it in this more complex context?

- Do some students require building a model? Can they find creative ways to model the situation by building their own models?
- For students who model with drawings, do they draw one side at a time or the entire box?

This task presents the opportunity to connect to important mathematical ideas:

- Modeling division by fractions (e.g., 2½ / ½ = 5) – the 2½" side would require 5 half inch cubes.
- The formula V=lwh can be used to find the total volume of the box, but this number would be equivalent to the number of 1" cubes. (Since this is conceptually difficult, it is also worth examining how one might model filling the box with one inch cubes.)
    - If using this task instructionally, it is valuable for students to consider the relationship between a half inch cube and a one inch cube (which may also require building a model since it is not as intuitive as it seems).

Construct Irrelevant Task Components

This item assesses the student's ability to determine the number of fractional edge length cubes that fit into a rectangular prism and relate this to the formula for volume of a rectangular prism. Support students' comprehension of the task as necessary by asking them to describe what the task is asking them to do. Additional support might include helping students construct visual models of the prism and the smaller cube if students suggest this as a viable solution strategy.

Selecting a Task Level at Post-Assessment

The post-assessment task is comparable to the pre-assessment/instructional task to provide evidence of student growth with respect to the content and practice standards. Three levels of the task for post-assessment provide variation to give more accurate student-level data across the achievement spectrum. Students who struggled most with the initial task might be given a nearly equivalent version (**Level 1**) to help the teacher determine whether the student is able to proceed with a solution strategy with less support than was needed for the initial task. Students who worked more independently on the initial task, but struggled to make connections to other aspects of the standard, such as the relationship to the formula for volume or division/multiplication of fractions, might try a slightly more complex version (**Level 2**). Students who applied one or more solution strategies to the initial task and were able to make connections to the formula for volume or division/multiplication of fractions in the context of the problem should try the most complex version (**Level 3**). If there is a question about which level a student should complete, give the *more complex* version. This ensures that the teacher gets the information he/she needs with respect to student growth (i.e., student-level growth will still be evident for a student attempting the more complex version when compared to pre-assessment).

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Tiered Post-Assessment Performance Task
Item Stem (Level 1 – Most similar to the Pre-Assessment/Instructional Stem): Mike is using cubes that measure ½ inch on each side to fill a box that has a height of 5 ½ inches, width of 3 inches, and length of 2 ½ inches. How many ½ inch cubes will Mike need to fill the box?
Item Stem (Level 2 – Requires student to consider different denominators in the fractional edge length cube and the prism): Mike is using cubes that measure ¼ inch on each side to fill a box that has a height of 5 ¼ inches, width of 3 inches, and length of 2 ½ inches. How many ¼ inch cubes will Mike need to fill the box?
Item Stem (Level 3 – Requires student to split fractional edge length cubes to fill the prism OR appropriately apply formulas OR effectively employ a strategy using division of fractions): Mike is using cubes that measure ¼ inch on each side to fill a box that has a height of 5 ¼ inches, width of 3 inches, and length of 2 ½ inches. How many ½ inch cubes will Mike need to fill the box?

Evidence of student growth may include the following observations:

- Much support needed to complete the task independently at pre-assessment and minimal or no support needed to complete the task at post-assessment;
- Students use manipulatives to model the entire task (fill the whole prism with cubes) at pre-assessment and fill only certain parts (e.g., only enough cubes to line the length, width and height) at post-assessment;
- Use of a different solution strategy from pre- to post-assessment (e.g., student uses visual models in pre but applies formulas or uses division of fractions to support work in post);
- Ability to apply a similar solution strategy at post-assessment, but to a more complex version of the problem;
- Ability to explain the reasoning of steps employed in a solution strategy more sophisticated and precise at post-assessment; or
- Other evidence that represents a change in the student's approach to the task, general ability to solve a problem of this type, or change in the efficiency with which the student carries out the necessary steps.

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