NJSLA Grade 5 Mathematics

Performance-Based Assessment
Measurement and Data
Volume

Rationale

- The CCSS requires students to understand the concept of volume using concrete manipulatives. The concept of volume should be extended from area with the idea that students are covering an area (the bottom of a cube) with a layer of unit cubes and then adding layers of unit cubes on top of the bottom layer. Prior to grade 5, students worked on liquid volume. Students develop their understanding of volume by finding that a 1-unit by 1-unit by 1-unit cube is the standard unit for measurement of volume.

Goals

- To find volume of rectangular prisms by counting units.
- To justify answers using precision.

Objectives

- Students will find volume of rectangular prisms by counting cubic units.
- Students will design a variety of rectangular prisms with a given volume.
- Students will justify answers with precision.

Standards

- **5.MD.3**. Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
  a. 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.
  b. 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.
- **5.MD.4.** Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

Materials

- Performance-Based Assessment Tasks-There are two separate Type II tasks.

- Journal
- Class Folder Labeled: Lesson 14: Performance-Based Assessment – Measurement and Data. (At the end of the lesson, place the class papers in the folder. If students used "scratch" paper, please have students attach the "scratch" paper to their Mathematics Items handout.)

Procedures

- Say, "This year, you will be taking the math NJSLA Assessment. It will test all of the things you have learned this year in math in order to find out if you have mastered the concepts or if you still need more practice. Today we will be learning about what you will need to know for the test. You will determine what is easy for you and what is challenging for you. We will then work on a plan for improving the areas which are difficult for you right now."
- Assign students to groups of 2 or 3. Give them the Performance Based Assessment. Tell students that this is an example of what a Performance Based Assessment may look like.
- Review the directions for the Tasks. Instruct students to record their answers on the assessment.
- Ask students to work in pairs and discuss each Task. Each student should complete their own assessment. Remind students to use clear explanations in their justification of their answers.
- While the students are working, circulate the room and monitor students' approaches. Note patterns of difficulty and/or errors.
- When students have finished, ask them to share their answers to the questions.

Assessment or Check for Understanding

- Journal writing: in the last 2-3 minutes of class, students should record what they learned about themselves regarding test taking strategies and the content of the CCSS.

Follow-up

- During any Performance Based Assessment mathematics lesson, engage students in a discussion of why one task was less challenging and another task more challenging.

NJSLA Technology Tips

- NJSLA equation editors are provided as the answer boxes for responses that include math, utilizing special mathematical functions. In this lesson, a written response is needed and the Open Response Equation Editor is provided. It is possible to respond with a combination of words and math.
- It is suggested that letters, numbers, and punctuation symbols from the standard keyboard be used. Any part of the response that indicates mathematical processes can be described using the function keys provided in the Open Response Equation Editor. When the pointer (curser) hovers over a function key, the name of the function appears as a pop-up;

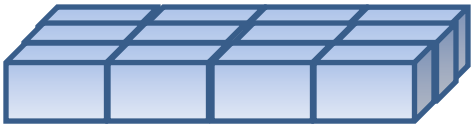
the question mark function represents the unknown in an equation. It is NOT possible to create diagrams, models and/or step-by-step solution processes in a vertical format (such as solving with an algorithm).

- See: NJSLA Practice with Equation Editor for online practice with the equation editors.

Task # 1(NJSLA 5.C.6)

PART A

A sugar company called **Sweetness**, is designing a box to hold sugar cubes. Two teams of designers are competing for the best design. Team A designed a box to hold 36 sugar cubes. One layer of sugar cubes is shown in the diagram below:



How many layers of sugar cubes are needed to fill the box? Explain your reasoning.

PART B

Choose the **three** designs that will hold 36 sugar cubes.

- ☐ 6 rows of 3 sugar cubes with 2 layers.
- ☐ 9 rows of 2 sugar cubes with 2 layers.
- ☐ 4 rows of 6 sugar cubes with 2 layers.
- ☐ 3 rows of 4 sugar cubes with 3 layers.
- ☐ 2 rows of 6 sugar cubes with 4 layers.

Task # 2 (NJSLA 5.C.6)

PART A

Team B designed a box to also hold 36 sugar cubes. One layer of cubes in shown below:

Team B claims they need 4 layers to fill the box. Is Team B correct or incorrect? Explain your reasoning.

PART B

Here are some other possible box designs. How many sugar cubes will each box hold?

3 rows of 3 sugar cubes with 3 layers ☐ sugar cubes

5 rows of 4 sugar cubes with 3 layers ☐ sugar cubes

6 rows of 3 sugar cubes with 4 layers ☐ sugar cubes

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Rubric

Task # __1__ Part A	
Score	**Description**
2	Student response includes each of the following 2 elements: Computation Component: 3 layers Reasoning Component: Valid explanation provided. Sample Student Response: I counted 12 cubes in the bottom layer. 12 x ? = 36 ? = 3 layers
1	Student Response includes 1 of the 2 elements.
0	Student Response is incorrect or irrelevant.

Task # __1__ Part B	
Score	**Description**
1	Student correctly selects: ☐ 6 rows of 3 sugar cubes with 2 layers. ☐ 9 rows of 2 sugar cubes with 2 layers. ☐ 3 rows of 4 sugar cubes with 3 layers.
0	Student Response is incorrect or irrelevant.

Task # __2__ Part A	
Score	**Description**
2	Student response includes each of the following 2 elements: Computation Component: Team B is incorrect. Reasoning Component: Valid explanation provided. Sample Student Response: Team B is incorrect. There are 12 cubes in each layer. 12 x ? = 36 ? = 3 layers. Team B has too many layers. 4 layers would be 48 cubes.
1	Student Response includes 1 of the 2 elements.
0	Student Response is incorrect or irrelevant.

Task # __2__ Part B	
Score	**Description**
1	27 60 72
0	Student Response is incorrect or irrelevant.