

Measurement / Number Sense and Numeration

Saving Space

The Task

This task required students to:

- construct open-top boxes with the greatest volume;
- investigate the relationship between surface area and volume.

For each of three sheets of square paper used to make open boxes, students removed different sizes of squares from the sheet corners to find the open box with the greatest volume. They used a guess-and-check or looking-for-a-pattern strategy and organized their findings in a chart to show how the volume changed as squares were removed. Students then compared the volume of the rectangular prism having the greatest volume with the volume of four rectangular prisms made of sheets formed by dividing the original square sheet into four congruent squares.

Next, students determined how to wrap with the least amount of foil a chocolate bar of given dimensions. They then determined the optimum size of packaging for soft drinks. Finally, they supported reasons for agreeing or disagreeing with a statement about the relationship between surface area and volume.

Expectations

This task gave students the opportunity to demonstrate their achievement of all or part of each of the following selected overall and specific expectations from two strands – Measurement, and Number Sense and Numeration. Note that the codes that follow the expectations are from the Ministry of Education’s *Curriculum Unit Planner* (CD-ROM).

Number Sense and Numeration

Students will:

1. solve and explain multi-step problems involving simple fractions, decimals, and percents (7m6);
2. use a calculator to solve number questions that are beyond the proficiency expectations for operations using pencil and paper (7m8);
3. perform three-step problem solving that involves whole numbers and decimals related to real-life experiences, using calculators (7m14);
4. ask “what if” questions; pose problems involving simple fractions, decimals, and percents; and investigate solutions (7m23).

Measurement

Students will:

5. apply volume formulas to problem-solving situations involving rectangular prisms (7m31);
6. describe measurement concepts using appropriate measurement vocabulary (7m33);
7. make increasingly more informed and accurate measurement estimations based on an understanding of formulas and the results of investigations (7m35);
8. understand the relationship between the dimensions and the volume of a rectangular prism (7m44);
9. calculate the surface area and the volume of a rectangular prism in a problem-solving context (7m45).

Prior Knowledge and Skills

To complete this task, students were expected to have some knowledge or skills relating to the following:

- thinking mathematically
- using concrete materials to develop a formula for finding the volume of a rectangular prism
- calculating surface area

For information on the process used to prepare students for the task and on the materials, resources, and equipment required, see the Teacher Package reproduced on pages 73–78 of this document.

Task Rubric – Saving Space

Expectations*	Level 1	Level 2	Level 3	Level 4
Problem solving				
The student:				
1, 3, 4, 5, 7, 9	<ul style="list-style-type: none"> – selects and applies a problem-solving strategy to perform three-step problem solving that involves whole numbers and decimals related to real-life experiences, arriving at an incomplete or inaccurate solution – selects and applies a problem-solving strategy to perform measurement estimations and calculations that involve the use of formulas, arriving at an incomplete or inaccurate solution 	<ul style="list-style-type: none"> – selects and applies an appropriate problem-solving strategy to perform three-step problem solving that involves whole numbers and decimals related to real-life experiences, arriving at a partially complete and/or partially accurate solution – selects and applies an appropriate problem-solving strategy to perform measurement estimations and calculations that involve the use of formulas, arriving at a partially complete and/or partially accurate solution 	<ul style="list-style-type: none"> – selects and applies an appropriate problem-solving strategy to perform three-step problem solving that involves whole numbers and decimals related to real-life experiences, arriving at a generally complete and accurate solution – selects and applies an appropriate problem-solving strategy to perform measurement estimations and calculations that involve the use of formulas, arriving at a generally complete and accurate solution 	<ul style="list-style-type: none"> – selects and applies an appropriate problem-solving strategy to perform three-step problem solving that involves whole numbers and decimals related to real-life experiences, arriving at a thorough and accurate solution – selects and applies an appropriate problem-solving strategy to perform measurement estimations and calculations that involve the use of formulas, arriving at a thorough and accurate solution
Understanding of concepts				
The student:				
8, 9	<ul style="list-style-type: none"> – demonstrates a limited understanding of the relationship between the dimensions and the volume of a rectangular prism – demonstrates a limited understanding of the concepts of surface area and volume 	<ul style="list-style-type: none"> – demonstrates some understanding of the relationship between the dimensions and the volume of a rectangular prism – demonstrates some understanding of the concepts of surface area and volume 	<ul style="list-style-type: none"> – demonstrates a general understanding of the relationship between the dimensions and the volume of a rectangular prism – demonstrates a general understanding of the concepts of surface area and volume 	<ul style="list-style-type: none"> – demonstrates a thorough understanding of the relationship between the dimensions and the volume of a rectangular prism – demonstrates a thorough understanding of the concepts of surface area and volume
Application of mathematical procedures				
The student:				
2, 3, 5, 7	<ul style="list-style-type: none"> – uses computations and mathematical procedures that include many errors and/or omissions when using a calculator and performing calculations 	<ul style="list-style-type: none"> – uses computations and mathematical procedures that include some errors and/or omissions when using a calculator and performing calculations 	<ul style="list-style-type: none"> – uses computations and mathematical procedures that include few errors and/or omissions when using a calculator and performing calculations 	<ul style="list-style-type: none"> – uses computations and mathematical procedures that include few, if any, minor errors and/or omissions when using a calculator and performing calculations

Expectations*	Level 1	Level 2	Level 3	Level 4
Application of mathematical procedures (cont.)				
The student:				
	– uses mathematical procedures that include many errors and/or omissions when determining the surface area and the volume of a rectangular prism	– uses mathematical procedures that include some errors and/or omissions when determining the surface area and the volume of a rectangular prism	– uses mathematical procedures that include few errors and/or omissions when determining the surface area and the volume of a rectangular prism	– uses mathematical procedures that are accurate, with few, if any, minor errors and/or omissions when determining the surface area and the volume of a rectangular prism
Communication of required knowledge				
The student:				
4, 6	– uses mathematical language and notation with limited clarity to describe measurement concepts and patterns	– uses mathematical language and notation with some clarity to describe measurement concepts and patterns	– uses mathematical language and notation clearly to describe measurement concepts and patterns	– uses mathematical language and notation clearly and precisely to describe measurement concepts and patterns

*The expectations that correspond to the numbers given in this chart are listed on page 12.

Note: This rubric does not include criteria for assessing student performance that falls below level 1.