



<b>Grade</b>	9 Applied
<b>Total time</b>	150 minutes (2 75-minute periods)
<b>Materials</b>	metric measuring tools, e.g., rulers and scales; manipulatives, e.g., linking cubes, rolls of tickets, popsicle sticks, grid paper
<b>Description</b>	<p>Students:</p> <ul style="list-style-type: none"> <li>investigate the dimensions of right prisms that create optimum models for solving the problem;</li> <li>use cooperative learning strategies to brainstorm ideas;</li> <li>use proportional reasoning to calculate the dimensions and volume of a rectangular prism and make predictions of other quantitative relationships;</li> <li>use manipulatives to design two models and submit or present a report that explains and justifies their choice of model;</li> <li>determine and justify the most economical holding container design.</li> </ul>
<b>Expectations Assessed</b>	<p><b>Mathematical Process Expectations</b></p> <p><b>MPS.01 • Problem Solving</b> • develop, select, apply, and compare a variety of problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;</p> <p><b>MPS.02 • Reasoning and Proving</b> • develop and apply reasoning skills to make mathematical conjectures, assess conjectures, and justify conclusions, and plan and construct organized mathematical arguments;</p> <p><b>MPS.03 • Reflecting</b> • demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem;</p> <p><b>MPS.05 • Connecting</b> • make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts;</p> <p><b>MPS.07 • Communicating</b> • communicate mathematical thinking orally, visually, and in writing, using mathematical vocabulary and a variety of appropriate representations, and observing mathematical conventions.</p> <p><b>Number Sense and Algebra</b></p> <p><b>NAV.01</b> • solve problems involving proportional reasoning;</p> <p><b>NAV.02</b> • simplify numerical and polynomial expressions in one variable, and solve simple first-degree equations.</p> <p><b>Measurement and Geometry</b></p> <p><b>MGV.01</b> • determine, through investigation, the optimal values of various measurements of rectangles;</p> <p><b>MGV.02</b> • solve problems involving the measurements of two-dimensional shapes and the volumes of three-dimensional figures.</p>
<b>Prior Knowledge/ Skills</b>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>calculate volumes of right prisms;</li> <li>calculate areas of polygons and circles;</li> <li>convert metric units for length, area, and volume;</li> <li>solve simple proportions.</li> </ul>
<b>Assessment Tools</b>	Rubric

**Description**

- Use cooperative learning strategies to brainstorm ideas.
- Use proportional reasoning to calculate the dimensions and volume of a rectangular prism and make predictions of other quantitative relationships.

**Materials**

- BLM 1.1
- placemats

**Assessment Opportunities**

**Minds On... Individual → Read for Information**

Students read the article and complete the questions (BLM 1.1).

Teacher circulates to clarify and provide feedback.

Students work with a partner to answer the following question:

If you were a member of the record breaking team, what things should you consider in planning and executing this event?

Suggested answers are: transportation difficulties and dealing with a frozen product on a hot day.

See pp. 58–60, *Think Literacy: Cross-Curricular Approaches Mathematics Grades 7–9*.

**Action!**

**Individual → Problem Solving**

Using the information from the article, students determine and record the dimensions and volume of the giant popsicle (BLM 1.1). They complete all questions on BLM 1.1.

Students submit their work.

Depending on your choice of model, students may need to approximate the dimensions of the popsicle.

Since the cross-sectional area can be a parallelogram or circle, students may need guidance in calculating the volume.

**Consolidate Debrief Small Groups → Debriefing**

Students share ideas the team could have used to prepare for the giant popsicle melting. Bring out the idea of building a holding container to catch the liquid from the melted popsicle.

**Learning Skills/Observation/Mental Note:** Observe students' cooperation with others as they work.



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## 1.1: Gathering Information

# New Yorkers flee from giant popsicle

## Streets closed as sticky treat melts Guinness stunt turns into PR disaster

Wednesday, June 22, 2005



**NEW YORK** — An attempt to raise the world's largest popsicle in a city square ended with a scene straight out of a disaster film — but much stickier.

The 7.6 metre-tall, 16-tonne treat of frozen Snapple juice quickly melted in the midday sun, flooding Union Square in downtown Manhattan with kiwi-strawberry-flavoured fluid that sent pedestrians scurrying for higher ground.

Some passers-by slipped in the pink puddles, and firefighters closed off several streets as they used hoses to wash away the sugary goo.

Snapple had been trying to promote a new line of frozen treats by setting a record for the world's largest ice on a stick, but called off the stunt before it was pulled fully upright by a construction crane on Tuesday.

Authorities said they were worried the thing would collapse in the 27-degree Celsius, first-day-of-summer heat.

"What was unsettling was that the fluid just kept coming," Stuart Claxton of the Guinness Book of Records told the Daily News.

"It was quite a lot of fluid. On a hot day like this, you have to move fast," he said. Snapple official Lauren Radcliffe said the company was unlikely to make a second attempt to break the record, set by a 6.4-metre ice pop in the Netherlands in 1997. "We planned for this. ... We just didn't expect for it to happen so fast," said Snapple spokeswoman Lauren Radcliffe. She said the company would offer to pay the city for the cleanup costs.

The giant ice pop was supposed to have been able to withstand the heat for some time, and organizers weren't sure why it didn't.

It had been made in Edison, N.J., and hauled to New York by freezer truck in the morning.

Source: Associated Press

## 1.1: Gathering Information (continued)

Questions I Have	Main Math Idea	Supporting Details	Math Words and Symbols

1. What are the important measurements given in the article?
2. A small frozen treat has these measurements:  
length = 2 cm          width = 2 cm          height = 10 cm  
Calculate the volume of the frozen treat:          volume =  
Calculate the dimensions and volume of the giant popsicle assuming it is proportional to the frozen treat measurements. Show all your work. Use appropriate units.  
length =                  width =                  height =                  volume =
4. Determine the number of small frozen treats that could be contained in the giant popsicle. Show a complete solution.
5. Determine what the giant popsicle would cost if the price was proportional to the price of the small one. A small frozen treat costs 50 cents. Show a complete solution.
6. Determine the mass of the small popsicle if the mass is proportional to the mass of the giant popsicle. Show a complete solution.

**Description**

- Use concrete materials to model and investigate the dimensions of at least two different rectangular prisms for a fixed volume and height.
- Determine and justify the most economical holding container design.

**Materials**

- BLM 1.2
- manipulatives: linking cubes, rolls of tickets, grid paper

**Assessment Opportunities**

**Minds On... Whole Class → Guided Discussion**

Read the problem on BLM 1.2 and ask:  
 If you know the height and volume of a prism, what information about the prism are you able to determine?  
 Students reflect on the problem.

Students should have an ample supply of grid paper to thoroughly investigate many models.

**Action! Individual → Investigation**

Students hypothesize potential rectangular prisms, investigate at least two models using manipulatives, record their results, and decide on the most economical model (BLM 1.2).  
 Students who finish early investigate the problem using a cylinder for the holding container and compare this to their rectangular prism container.  
 Students submit their responses.

Provide data for those students who were unsuccessful on Day 1.

A cylinder is the most economical figure. Its circular base has the smallest perimeter.

**Consolidate Debrief Whole Class → Data Collection**

Gather dimensions from students. On an overhead or on the board, make a scatter plot of length versus perimeter. Discuss the data on the scatter plot.  
 Emphasize that all squares are rectangles.  
 Students reflect on prior work that a square maximizes area for a fixed perimeter.

Some of the student dimensions may contain non-integral values.

The problem leads to Fermi problems such as how many trees would be required to make all the small popsicles sticks.

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## 1.2: Fixing a Sticky Situation

According to the article, as the popsicle melted, the gooey liquid flowed into the street. Your task is to design a holding container to catch all possible fluid running off the giant popsicle. The material used to build the walls of the container can be cut into different lengths but the material is 0.6 metre high. It is important to keep building costs reasonable, so the holding container needs to have a minimum perimeter.

### Whole Class – Guided

Important information from the problem:

1. Enter your data from Day 1. Use appropriate units.

Giant Popsicle Statistics from Day 1			
Length	Width	Height	Volume

2. Explain how knowing that the height of the container is 0.6 m affects the problem.
3. **HYPOTHESIS:** What shape of holding container do you think will have a *minimum perimeter*? (You may revise this hypothesis later as you gather data.)
4. Using concrete materials, build models to represent your holding container. Include sketches of at least two models with labelled dimensions. *Attach your graph paper sketches of preliminary models.*

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## 1.2: Fixing a Sticky Situation (continued)

4. Complete the following table for your models:

Model 1	Model 2
Shape	Shape
Sketch with labelled dimensions	Sketch with labelled dimensions
Volume	Volume

5. Write a conclusion.

Justify that your holding container:

- has a minimum perimeter;
  
- is able to contain all possible fluid.