Unit 5: Day 11,12 & 13: Summative Task Packaging Project

Minds On: 25 Action: 170 Consolidate:30 Total=225 min	**Learning Goal**: • Solve surface area problems involving rectangular prisms, triangular prisms, cylinders, and composite figures • find the minimum surface area for a given volume • use imperial to metric conversions and visa versa when necessary • find the area of rectangles, triangles, and circles, and of related composite shapes, in situations arising from real world applications • solve volume problems involving rectangular prisms, triangular prisms, cylinders and composite figures	**Materials** • BLM 5.11.1 • BLM 5.11.2 • BLM 5.11.3 • BLM 5.11.4 • BLM 5.11.5 • BLM 5.11.6 • Chart Paper • Graphing Calculator

			Assessment Opportunities
	Minds On…	**Groups of 3 or 4 → Graffiti** Introduce the students to the problem by showing the examples of packaging that you brought in. Tell students that they will be completing an exploration to design the best package. Indicate to students posted on the wall, chart paper with the following titles: Size, Cost, Appearance and Marketing. In groups of 4, students start at one piece of chart paper and brainstorm what considerations are important when designing an appropriate package for a product. One member of the group should record the ideas on the posted chart paper. After 5 minutes, the groups move on to the next chart and add to what has already been written. Continue on in this way until all groups have visited all four charts have been visited by all groups. **Whole Group → Discussion** Have each group summarize the main ideas on the charts in front of them. .	It would be beneficial to bring in examples of product packaging to refer to throughout the project. Rectangular prism (e.g. Smartie box) Cylinder (e.g. M&M canister) Triangular Prism (e.g. Toblerone) Different coloured markers can be used with each group.
	Action!	**Pairs → Summative Performance Task** Assign pairs to work together on this summative. Introduce the task: Keeping the Kandies (BLM 5.11.1 - 5.11.5). These can be given all at once, or in stages as students complete the work. Read through the instructions and answer any questions the students may have. Encourage students to use their notes and graphic organizers from the unit when completing this summative. Distribute the rubric for the tasks (BLM 5.11.6) for students to refer to while working through the activities. **Learning Skills (Teamwork/Initiative)/Observation/Anecdotal:** Observe pairs as they work through the investigation and make anecdotal comments. **Mathematical Process Focus: Connecting** Students will **connect** to prior knowledge and to a real-world application of optimal measurements.	To make the investigation manageable, it is designed to work with a right triangular prism that is isosceles. Note: Part 1 of the activity does not require the dimensions to be a maximum.
	Consolidate Debrief	**Whole Class → Discussion** For the last ten minutes of each class, have pairs report on their progress. Discuss any problems that students are having and possible solutions. Give the students an idea of how far along they should be in their project in order to complete it within the specified timeframe.	
Application		**Home Activity or Further Classroom Consolidation** Review notes as needed to help you complete tomorrow's tasks. Complete any parts of today's tasks that you were not able to complete during class time.	

5.11.1: Keeping the Kandies MAP4C

Names: _____ Date: _____

You are applying for a job with The N & N Kandy Company's packaging department. As part of the application process the company has requested that you prepare a report suggesting possible packaging alternatives for their candies. The company has indicated that the package must contain 500 candies, each having a volume of $0.4cm^3$. In addition to the size, the material cost is a consideration for the department. .

What is the necessary volume of eachpackage of candies?

_____

Part 1 – Containing the Candies

You are told that the package will either be a *rectangular prism*, a *right isosceles triangular prism* or a *cylinder*. You must design one container for the 500 candies for each of these 3-D shapes. Your design must include a 3-D sketch labelled with the appropriate dimensions, the volume calculation to verify the package is the correct size and the surface area calculation.

Rectangular Prism

3-D Sketch	Volume Calculation
	Surface Area Calculation

5.11.1: Keeping the Kandies (continued) MAP4C

Right Isosceles Triangular Prism

3-D Sketch	Volume Calculation
	Surface Area Calculation

Cylinder

3-D Sketch	Volume Calculation
	Surface Area Calculation

5.11.2: Keeping the Kandies MAP4C

Names: _____ Date: _____

The company was impressed with your first submission, and would like you to further investigate packaging solutions for the candies.

Part 2 – Keeping The Material Costs Low

The N&N Kandy Company would now like you to choose one of the above shapes for their container. The container you choose should be both aesthetically pleasing and also keep the material costs low. Your choice must be justified, so your report must include calculations for the optimal surface area of all shapes.

Notes:

- The material for the packaging costs $\$0.0005/cm^2$.
- All costs must be rounded to the nearest tenth of a cent.

Show all your work on the pages that follow.

Once you have completed all calculations, summarize your findings below and give your recommendation for which shape the company should use for the new N&N Kandy's package and its dimensions. Remember to justify your choice.

Report

5.11.2: Keeping the Kandies (continued) MAP4C

Steps for the Rectangular prism and the Cylinder

1. Find the dimensions that will minimize the surface area of the package that the company requires for its candies.
2. Determine the cost of the material that produces one package.
3. Draw a 3-D sketch of this package design.

Rectangular Prism

Hint: What is special about the rectangular prism that minimizes surface area?

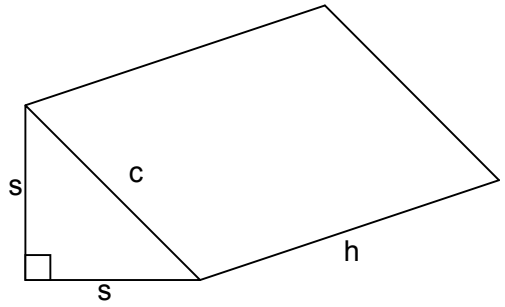
Cylinder

Hint: What is special about the cylinder that minimizes surface area?

5.11.2: Keeping the Kandies (continued) MAP4C

To determine the optimal surface area for the triangular prism shown below, fill in the table below and graph side length (S) vs. Surface Area on a graphing calculator with a curve of best fit. Round all answers to the nearest tenth.

Right Triangular Prism



S	h	c	Surface Area
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Sketch of Graph

Optimal Dimensions and Cost

5.11.3: Keeping the Kandies MAP4C

Part 3 – Considering Candy Packaging Costs

The American arm of the company has found that they can get the same material to make the package for $\$0.0033/in^2$ (CAD).

Calculate the cost of packaging for the container you chose.

Conversions

Cost

The packages are to be manufactured in Canada. Would you recommend using the original material (from a Canadian supplier) or the material from the American supplier? Be sure to justify your choice.

5.11.4: Keeping the Kandies MAP4C

Names: _____ Date: _____

Part 4 – Creating The Perfect Logo

You are to design a graphic logo for N & N's that will fit on **one** of the faces of your chosen package. Your design must meet the following criteria:

- The area of your label must take up 50% to 80% of the surface you have chosen
- It must contain at least two different geometric shapes (circle, square, triangle, etc.)
- The name of the candy (N & N's) must be clearly visible on the logo

In the space provided below,

- draw an accurate 2-D representation of the container face with your logo on it (you may wish to draw a rough sketch on separate paper first).
- Show that your logo satisfies the above criteria and include all calculations.

5.11.5: Keeping the Kandies MAP4C

Names: _____ Date: _____

Part 5 – Capturing the Olympic Spirit

The final task is to design a different, novelty package for the candies to coincide with the 2010 Vancouver Winter Olympic Games. They want 3-D packages that represent different aspects of the games. Your package could be something from the medal ceremony or part of an individual sport…be creative!

It should be made up of **at least three** 3-D shapes (e.g. 2 cylinders and a rectangular prism) and hold **no more than 2000** candies in **total** (remember each candy is 0.4 cm^3).

Include the following in the space provided below (you may use the back of this page if you need more room):

1. A sketch of your package with dimensions shown on it
2. Volume calculations to show that the package will not hold more than 2000 candies
3. The cost of the material used to create the package.

5.13.6: Keeping the Kandies: Evaluation Rubric

Part 1

Category: Knowledge

Processes	Criteria	Level 1	Level 2	Level 3	Level 4
Exploring and Reflecting	Collection of data and exploration of the problem	Creates a model that is connected to the problem, yet inappropriate for the inquiry	Creates a model that is appropriate and connected to the problem, yet missing some requirements	Creates a model that is appropriate and connected to the problem, meeting all requirements	Creates a model that is appropriate and connected to the problem, meeting all requirements, with a high degree of accuracy

Part 2

Category: Application

Processes	Criteria	Level 1	Level 2	Level 3	Level 4
Connecting (rectangular prism and cylinder)	Make connections among mathematical concepts and procedures discussed throughout the unit	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Exploring and Reflecting (triangular prism)	Collection of data and exploration of the problem	Gathers data that is connected to the problem, yet inappropriate for the inquiry	Gathers data that is appropriate and connected to the problem, yet missing many significant cases	Gathers data that is appropriate and connected to the problem, including most significant cases	Gathers data that is appropriate and connected to the problem, including all significant cases, including extreme cases

Part 3

Category: Inquiry

Processes	Criteria	Level 1	Level 2	Level 3	Level 4
Reasoning and Proving	Justification of chosen dimensions for the package	Justification of chosen dimensions for the package has a limited connection to the models presented	Justification of chosen dimensions for the package has some connection to the models presented	Justification of chosen dimensions for the package has a direct connection to the models presented	Justification of chosen dimensions for the package has a direct connection to the models presented, with evidence of reflection

5.13.6: Keeping the Kandies: Evaluation Rubric (continued)

Part 4

Category: Application

Processes	Criteria	Level 1	Level 2	Level 3	Level 4
Representing	Creation of a model to meet the specified requirements	Creates a model that meets a limited amount of the requirements	Creates a model that meets most of the requirements	Creates a model that meets all of the requirements	Creates a model that exceeds the requirements

Part 5

Category: Inquiry

Processes	Criteria	Level 1	Level 2	Level 3	Level 4
Representing	Creation of a model to meet the specified requirements	Creates a model that meets a limited amount of the requirements	Creates a model that meets most of the requirements	Creates a model that meets all of the requirements	Creates a model that exceeds the requirements

Overall

Category: Knowledge

Selecting Tools and Computational Strategies	Select and use tools and strategies to solve a problem	Selects and applies appropriate tools, with major errors, omissions, or mis-sequencing	Selects and applies appropriate tools, with minor errors, omissions or mis-sequencing	Selects and applies appropriate tools, accurately, and logically sequenced	Selects and applies the most appropriate tools, accurately and logically sequenced

Category: Communication

Communicating	Correct use of mathematical symbols, labels, units and conventions	Sometimes uses mathematical symbols, labels and conventions correctly	Usually uses mathematical symbols, labels and conventions correctly	Consistently uses mathematical symbols, labels and conventions correctly	Consistently and meticulously uses mathematical symbols, labels and conventions, recognizing novel opportunities for their use