Math, Grades 1-2

Packaging for a Present

Critical Question:
Would Santa's new toy be best packaged in a cylinder, hexagonal prism, or cube?

Students will investigate the attributes of several geometric shapes and make a recommendation as to which shape is the best for the toy's package. Recommendations will be based on two criteria and supported with proof from their investigations. Student recommendations will be presented in report form.

OVERVIEW

In this challenge, students investigate the attributes of two-dimensional shapes and three-dimensional figures and communicate their findings through a report by helping Santa decide how to best design packaging for a new toy. Students investigate and develop insights about the characteristics of two-dimensional shapes and three-dimensional figures and the interrelationships of shapes by visualizing and comparing shapes and figures in various positions (The Ontario Curriculum, Grades 1-8, Mathematics, p. 9). They will also use reasoning to arrive at a plausible answer using evidence they find in their explorations and investigations and will communicate the results in report format. (The Ontario Curriculum, Grades 1-8, Language, p. 42-43)

OBJECTIVES

Broad understanding:

- Different shapes have different attributes. Some shapes are better suited for specific purposes. Some shapes will fill a container more efficiently than others.

Overall Expectations Assessed:

- Identify common two-dimensional shapes and three-dimensional figures and sort and classify them by their attributes.
- Gather and organize ideas and information to write for an intended purpose and audience.

Specific Expectations Addressed

- Identify and describe common three-dimensional figures and sort and classify them by their attributes.
- Describe similarities and differences between an everyday object and a three-dimensional figure
- Identify and describe shapes within other shapes
- Describe the relative locations of objects or people using positional language

- Gather information to support ideas for writing in a variety of ways and/or from a variety of sources
- Write short texts using a few simple forms
- Make simple revisions to improve the content, clarity, and interest of their written work using a few simple strategies
- Begin to establish a personal voice in their writing by using pictures and words that convey their attitude or feeling towards the subject or audience

REQUISITE TOOLS

Background knowledge:

- Knowledge of two-dimensional shapes and three-dimensional figures.
- Knowledge of how to record simple observations in a journal format.

Criteria for judgment:

- stacks well in a truck
- protects the toy during shipping (doesn't leave big gaps, doesn't move around a lot)

Critical Thinking Vocabulary:

- argument
- criteria
- evidence

Thinking Strategies:
Graphic organizers

- KWC chart

Anchor charts

- Journal
- Report format

Habits of Mind:

- Critically minded
- Persistence/perseverant
- Respectful
- Constructive

SUGGESTED ACTIVITIES

Pre-planning

- Print Mrs. Moher's letter on chart paper and put it in an envelope addressed to the class (ideally send this letter to the school through Canada Post).
- Arrange for a guest speaker to come to the classroom to speak to students (e.g., Fed Ex, UPS, Scholastic, Board Courier) about the shapes of packages that they usually transport and how they stack the packages in the vehicle to offer the most protection to the packages.
- Gather mini-chalk boards, clipboards or white boards for students to use to record information from the visitor interview.
- Find three different balls to use for the ball experiment (Hacky Sack ball, basketball, small rubber bouncy ball).
- Gather a variety of three-dimensional solids (several of each solid).
- Gather a number of cylinders, cubes and hexagonal prisms (all cylinders the same size, all cubes the same size, all hexagonal prisms the same size).
- Find nets for a cylinder, cube and hexagonal prism (similar in size). Copy two of each of these nets onto overhead transparencies. Cut, fold and tape one net of each solid to create a cylinder, cube and hexagonal prism (leave the top open). Cut and fold the other nets and keep as a visual reference.
- Find a spiral toy ("Slinky" or other small thin toy) that will fit into each of the solids.
- Bring in a shoebox or other small box for students to use to stack the solids in. Bring a toy truck or wagon that can be used to transport the solids from one point to another.

- Create a Blackline Master with pictures of the various solids so students can use these to record their sorting and their ranking of the solids.

INTRODUCE THE SCENARIO/PRESENT THE CRITICAL CHALLENGE

KWC Chart

- Have the Secretary or Principal deliver Mrs. Moher's letter to the class. Open the letter and read it aloud to the class. The letter asks the students to investigate three-dimensional shapes to determine which shape would be the most appropriate to use as a package for a new toy.
- As a shared reading exercise, the teacher and the students create a KWC chart -What I Know, What I'm Trying to Find Out, Any Special Considerations (Hyde, 2006). To do this the teacher and students read the letter and deconstruct it to determine what they are being asked to do. Information is underlined in the letter and recorded in the appropriate column on the chart.
- Create a plan of action for what needs to be learned/done (for example, we need to know what these shapes look like, we need to see which one stacks the best, we need to know how to write a report, etc.)

CREATING POWERFUL QUESTIONS

- Explain to student that the class will have a visitor who will answer our questions about packaging.
- Use the 'Powerful Questions' critical challenge from Critical Challenges Across the Curriculum by Roland Case and LeRoi Daniels to design appropriate questions for our visitor.

GATHERING INFORMATION

- Welcome the visitor into the classroom. Have students ask the questions that the group created. Video tape (or audio tape) the interview so the responses can be viewed/listened to again by the group.
- As students are listening, they can draw or write any key pieces of information they learn from the visitor on their clipboards or white boards.
- After the visit students complete a journal entry, "What I learned about shipping packages from our visitor…" This information will be helpful when students are writing their reports.

MODELING THE USE OF CRITERIA

- Explain to students that in order to make a decision we will have to think about our options using the criteria outlined in the letter. Explain that to prepare to do that, the class will practice thinking about criteria with a different activity.
- As a group conduct an experiment on selecting a ball for the school yard in order to model the collection of data and note-taking that students will do for the toy.
- Use the criteria 'bounces well' and 'easy to throw and catch'. For each ball, create a chart with three columns. Title the columns: Ball Name, I See and I think.
- For each ball have a couple of students try out the ball (bounce it, throw and catch it). Record their observations in the 'I See' column. In the 'I think" column, record inferences about the ball using the criteria and student inferences (e.g., the Hacky Sack ball does not bounce, only one or two students would be able to play with the ball at a time, it would be hard for a grade one to do, etc.). Repeat this process for each of the balls.

MODELING THE DECISION MAKING PROCESS

- Using a shared writing approach, model writing a report for the class choice for 'best ball for the school yard'. On chart paper, create a report form like Blackline Master #4 'Report Form for Santa's Toy'. Refer to the 'I See', 'I Think' charts created for the different types of balls.
- Invite student to use the information collected in those experiments to help to decide which would be the best ball to purchase for the yard.
- Work with students to complete the ranking section and the sections titled, 'I would recommend…' and 'I would not recommend…'

ASSESSING THE OPTIONS

Blackline Master #1, 2 and 3 (Observation Recording Sheet Station 1, 2 and 3)

- Explain to students that they will visit 3 different stations. At each station, students will be working with the solids to learn about their attributes and to help them determine what solid they would recommend to Santa as the package for his new toy.
- Explain to students that they will work with one type of solid at a time when conducting these experiments (for example, work with the cylinders and see how they stack, then work with the cubes and see how they stack, and so on)
- Divide students into groups of three to rotate through stations. As they work with the shapes, invite them to record their observations in the 'I See' column and their inferences in the "I Think' column.

EXPLANATION OF THE STATIONS

Station # 1
Students place shapes in a small box to investigate how well the shapes stack and fit together (amount of space between shapes and the stability of the shapes when stacked). The box represents the truck that will be used to transport the toys to Santa's workshop.

Station # 2
Students load the shapes into the back of the truck and they investigate what happens to the shapes when the truck moves, turns or 'hits a bump in the road'.

Station # 3
Students explore the attributes of the solids and sort them in a variety of ways (stack, roll, stability, number and shape of faces). Note: This station may not be necessary at this time if there are sufficient solids for students to use if the class is divided in two groups.

MAKING A JUDGMENT

- Blackline Master #4 'Report Form for Santa's Toy'
- Invite students to evaluate each of the solids using the two criteria on the sheet.
- Ask them to glue cut-out pictures of the solids onto their sheets to rank them in order from the solid that provides the most protection to the toy to the solid that provides the least protection to the toy.
- Next, they complete the sections "I would recommend…" and 'I would not recommend…" using information from the class visit and their notes from the experiments.

KWC CHART

What do you know for sure?	**What are you trying to find out?**	**Are there any special considerations? (Special rules? Tricks to watch out for? Things to remember?)**
I know that	I'm trying to	I need to

Source: Comprehending Math by Arthur Hyde, 2006.

April 21, 2008

Miss Morrison's Class
Harmony P.S.
1951 Laurmark Rd.,
Cobourg, ON K9A 1M7

Dear Friends,

How are you? I am really enjoying my new job but I miss working with you and Miss Morrison so much!

I am writing because I need your help. I was working with some of my Math friends in Toronto on the weekend. We were talking about the best package to use to send a new toy Santa's Elves have made to Santa's storage shed. The packages will be sent to the shed in a truck. We looked at a cylinder package, a hexagonal prism package and a cube package but we could not agree which one was the best to use! I told my Math friends that you would be able to help us because you are such great thinkers.

Could you work with the shapes and see which one would be the best shape for the package? Here is the criteria you need to use when you decide:

- stacks well in a truck
- protects the toy during shipping (doesn't leave big gaps, doesn't move around a lot)

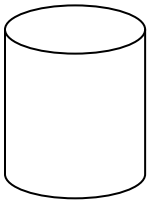
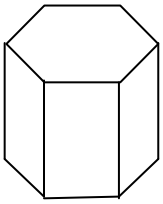
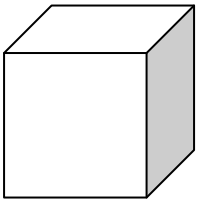
I need you to send me your recommendations in an official report that I can share with my Math friends.

Thank you in advance for your expert help!

Your friend,
Mrs. Moher

Station 1

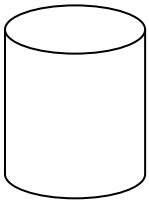
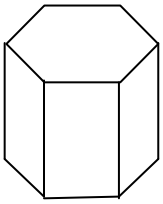
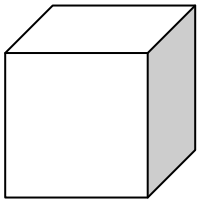
HOW WELL DO THE SOLIDS STACK?

Shape	I See…	I Think…
 Cylinder		
 Hexagonal Prism		
 Cube		

My Observations

Station 2

HOW WELL DOES THE SOLID PROTECT THE SHAPE?

Shape	I See…	I Think…
 Cylinder		
 Hexagonal Prism		
 Cube		

My Observations

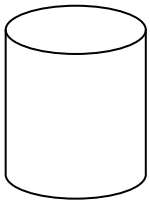
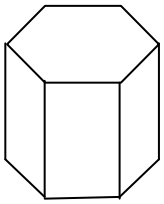
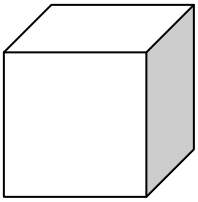
Station 3

Work with the three dimensional solids. Find different ways to sort the solids. Ways you might try sorting:

- the number of faces
- the shape of the faces
- do they roll?
- do they stack?
- do they tip?

My Observations

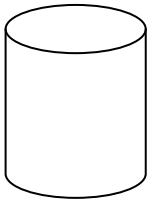
Santa's Toy Report Form

Shape	Criteria
 Cylinder	☐ stacks well ☐ protects the toy during shipping
 Hexagonal Prism	☐ stacks well ☐ protects the toy during shipping
 Cube	☐ stacks well ☐ protects the toy during shipping

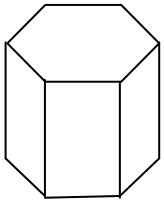
Glue the package shape pictures below. Number 1 protects the toy the most. Number 3 protects the toy the least.

1	**2**	**3**

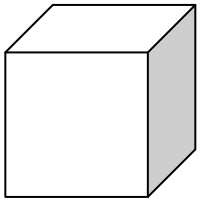
I would recommend (circle one)



Cylinder



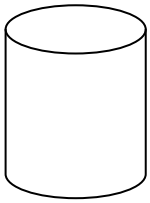
Hexagonal Prism



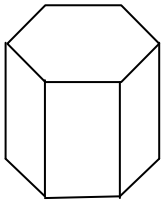
Cube

because…

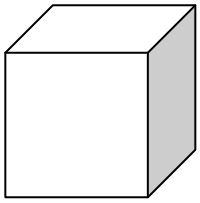
I would NOT recommend (circle one)



Cylinder



Hexagonal Prism



Cube

because…