PBL - Build a Container

Middle

Common Core State Standards

CCSS.ELA-Literacy.RST.6-8.3
Key Ideas and Details

- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7
Integration of Knowledge and Ideas

- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

CCSS.ELA-Literacy.SL.6.1d
Comprehension and Collaboration
Engage effectively in a range of collaborative discussions (one- on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- Review the key ideas expressed and demonstrate understanding of multiple perspectives through reflection and paraphrasing.

CCSS.ELA-Literacy.SL.6.4-5
Presentation of Knowledge and Ideas

- Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
- Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

CCSS.Math.Content.6.RP.A.3
Understand ratio concepts and use ratio reasoning to solve problems.

- Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

CCSS.Math.Content.6.NS.C.7b
Apply and extend previous understandings of numbers to the system of rational numbers. Understand ordering and absolute value of rational numbers.

- Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write –3°C > –7°C to express the fact that –3°C is warmer than –7°C.

CCSS.Math.Content.6.RP.A.3b
Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

CCSS.Math.Content.6.G.A.1
Solve real-world and mathematical problems involving area, surface area, and volume. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

CCSS.Math.Content.6.G.A.4
Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Materials

- Cardboard
- String
- Foam
- Paper
- Tape
- Glue
- Cloth
- Rubber Bands
- Measuring tape or ruler
- Rubik's Cubes

Objective

1. Students will review and apply math skills: area, perimeter, and nets
2. Students will review and apply physics skills (force=mass x acceleration)
3. Work cooperatively in groups
4. Organize thoughts and create "talking points" for presentation, focusing on proper communication skills

Scenario

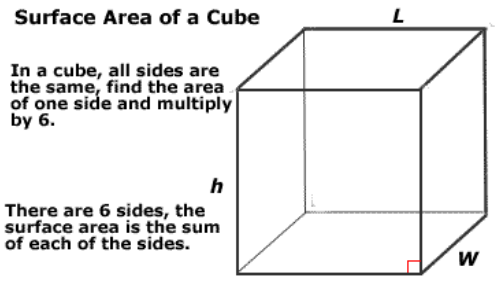
You are the design engineers at a packaging company and you have been contacted to design a container to hold a new kind of Rubik's Cube. The product is the same size as the original Rubik's Cube, but it's made of beautiful glass cubes instead of the traditional plastic cubes with stickers that can be peeled off. The container must hold 20 cubes and prevent them from being broken during the shipping process. The company also asks that you use as little materials as possible due to cost efficiency. Size of the container is a concern as well due to high shipping costs. You present to the company in just two weeks!

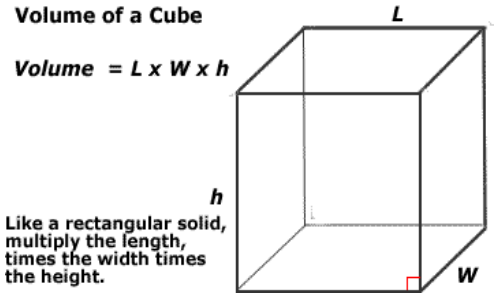
Task

1. Create a blueprint for your container prior to building. This will ensure that your group will:
   - Visualize the end result
   - Have something to reference
   - Plan on everything fitting together
   - Know things will look right
   - Eliminate building by trial and error
2. Build your container based on your blueprint. The container must:
   - Allow consumers to easily remove cubes from packaging
   - Have dimensions no greater than 36”x36”x18”
   - Weigh no more than 8lbs (including 20 Rubik’s Cubes, assuming they are the same weight as the plastic cubes)
3. Design a presentation for the company that includes:
   - Proof your container will prevent glass Rubik’s Cubes from breaking
   - Proof your container is inexpensive to produce
   - Proof your container is inexpensive to ship

Notes to Teacher

- *Students will need to measure the Rubik’s Cube so they may need a brief review the geometry of a cube.*
- *Students may need to be introduced to force (F=Mass x Acceleration) to take into consideration for the glass cubes breaking if dropped.*





Evaluation:

RUBRIC	4	3	2	1
ORGANIZATION 15%	We present our data and plan in a clear and logical sequence that is complete and easy to follow.	We present our data and plan in a logical sequence that is complete and relatively easy to follow.	We present our data in a manner that is complete, but its disorganization often makes it difficult to follow.	Our presentation is incomplete and/or disorganized.
SUBJECT KNOWLEDGE 30%	We demonstrate our understanding of the mathematical concepts related to the project (area, perimeter, & force) with explanations that are clear, thorough, and mathematically correct.	We demonstrate our understanding of the mathematical concepts related to the project (area, perimeter, & force) with explanations that are mathematically correct.	We demonstrate our understanding of the mathematical concepts related to the project (area, perimeter, & force) with explanations that are primarily mathematically correct.	We are unable to adequately answer questions related to the mathematical concepts of the project (area, perimeter, & force)
PUBLIC SPEAKING 15%	We speak so that our presentation can clearly be heard; we use proper grammar and correct pronunciation; we appropriately use mathematical vocabulary to demonstrate an understanding of the terms.	We speak so that our presentation can generally be heard; we generally use proper grammar and correct pronunciation; we use mathematical terms properly.	We speak softly so that our presentation is difficult to hear; at times, our use of grammar and pronunciation detracts from the presentation; we use mathematical terms appropriately, but infrequently.	We speak softly so that our presentation is difficult to hear; our use of grammar and pronunciation detracts from the presentation; we seldom use mathematical terms, or use them inappropriately.
GROUP PARTICIPATION 15%	Each member of our group participated with relatively equivalent roles.	Each member of our group participated, but our roles were not equivalent.	Each member of our group participated, but not all spoke.	Not all members of our group participated in the presentation.
Presentation 25%	Our presentation is designed to explain and support our product (container).	Our presentation is related to our product (container).	Our presentation often distracts from our product (container).	Our presentation is unrelated to our product (container).
Total Score	_____/20			