STEM SCHOOL CHATTANOOGA
Mini-PBL
Unit Plan Template

That's A Wrap: Designing the Ultimate Candy Container

Geometry

Standards (Learning Targets)

Learning Target 13: The Third Dimension - I can expand geometric concepts to three dimensions.

Grade Level	9th	Unit Length	3 Weeks
Mini-PBL Overview	Students will use their understanding of the properties of three dimensional solids to design a candy container meeting specific constraints. Students, working in pairs, will complete a two and three dimensional design using Tinkercad. Students will also create a cardboard box using the Carvey or laser cutter and decorate the outside of the container.		
Mini-PBL Driving Question	How can we, as consultants to Mars Inc., design a functional and eye catching candy container to celebrate the anniversary of the iconic candy M&M's, applying our knowledge of three dimensional solids?		
Hook Event	Students will try to accurately estimate the number of M&M's in various shaped candy jars. Given an 8 by 11 piece of paper, students will be challenged to fold the paper in a way that will hold the most M&Ms. The group whose paper figure holds the greatest number will be awarded M&Ms.		
Scaffolding Activities	**Class Activities** ❏ Review Rubric: Teacher and students will review components of rubric. ❏ Math Concepts: Conceptual learning and application of formulas used in determining volume and surface area of three dimensional figures such as prisms, cones, cylinders and Pyramids using Khan Academy. ❏ First Draft: Create a sketch, including accurate dimensions, of a container, including net. ❏ Prototyping: Create a prototype using laser cutter or Carvey. **Station Activities** ❏ Product Design: Use Design software to create a 3D Representation. ❏ Prototyping: Create a prototype using laser cutter or Carvey. **Workshops** ❏ The following digital fab options: ❏ Use of Arduino in project to illuminate the container or to incorporate sound. ❏ Use of Carvey ❏ Vinyl Cutter **Focus Groups** ❏ Based on results of Khan Academy assignments, students will participate in the following focus groups: ❏ Review of formula and practice calculating volume. ❏ Review of and practice calculating surface area. ❏ Review and practice calculating composite figures. ❏ Review and practice of changing dimensions. **Mini-PBL Teams** ❏ Teams will be composed of pairs of students of similar math ability and digital fabrication experience. Contracts will be employed to detail roles and responsibilities of each group member.		

Digital Resources

- TinkerCad
- Laser Cutter
- Carvey
- Vinyl Cutter
- Arduino
- Computer

Calendar Overview

Monday	Tuesday	Wednesday	Thursday	Friday
HOOK EVENT CLASS ACTIVITY: Review Rubric	CLASS ACTIVITY: Math Concepts	CLASS ACTIVITY: Math Concepts	CLASS ACTIVITY; Math Concepts First Draft	CLASS ACTIVITY; Math Concepts
STATION: Product Design	STATION: Product Design FOCUS GROUP: Volume and Surface Area	CLASS ACTIVITY; Math Concepts	STATION: Prototyping WORKSHOP: Digital: Arduino, Carvey, Vinyl Cutter FOCUS GROUP: Composite Figures	STATION: Prototyping WORKSHOP: Digital: Arduino, Carvey, Vinyl Cutter
CLASS ACTIVITY: Prototyping	CLASS ACTIVITY: Prototyping	CLASS ACTIVITY: Prototyping	CLASS ACTIVITY: Prototyping	CULMINATING EVENT: Candy Bar

Culminating Event

Product

- ❑ Students will create a candy container that is at least 64 square inches.
- ❑ Students will use 3D Design software, a laser cutter or Carvey.

Showcase

- ❑ Students will share containers at a "candy bar".

Common Assessment

Mini-PBL Rubric

	Advanced	Proficient
LT13 - I can expand geometric concepts to three dimensions.	❑ Students will answer the advanced level question that was assigned in class in a separate document. https://docs.google.com/document/d/1Vw0LiC8Q9Lt_yQkNnLq3yPiDNq4Btapq8_FtkEawdpo/edit?usp=sharing ❑ Students will calculate the area of the composite container.	❑ Students will construct a solid (prism, cylinder, pyramid or cone) from rigid or semi rigid material. ❑ Faces meet at vertices. ❑ Accurate description including classification, dimensions, faces, edges, vertices. ❑ Accurate calculation using formula.
Innovation: Originality	❑ Students will construct candy containers that are composite figures. ❑ Containers will have digital joints. ❑ Students will use an arduino to incorporate either lights or sound. .	❑ Students will create a container whose shape is **not** a rectangular prism. ❑ The container should be decorated using a vinyl cutter or laser engraver.

	Minimum Requirement Components: Must be included to be graded	❑ 3D solid volume is at least 64 cubic inches. ❑ Students will use 3D Design software, a laser cutter or Carvey. ❑ Students must attempt to calculate the volume and surface area of the figure. ❑ Students must include a description of the figure.
	Grades	❑ If the Mini-PBL work is all advanced according to the rubric criteria above, the grade is a 100. ❑ If the work meets all the proficient criteria and not all of the advanced criteria, the grade is an 85. ❑ If the work does not meet all of the proficient criteria, the grade is a 50. ❑ If the grade does not meet the minimum requirements, the grade is a 0.
Vocabulary		
	Mathematics – Geometry	1. Volume 2. Surface Area 3. Lateral Area 4. Pyramid 5. Cone 6. Prism 7. Cylinder 8. Sphere