

3-D BUBBLE WANDS

Have you ever explored 3-D shapes with bubbles? This STEM project will help you learn structural engineering by building 3-dimensional bubble wands. Bubbles are clear and are an invisible form of water. When the bubbles are in a 3-D shape, you can observe them more vividly and in detail. At Idaho National Laboratory, some facilities have radiation detectors that employees must pass to make sure they do not have any radiation particles on their clothes before leaving the facility. Radiation particles or waves are invisible and similarly, bubbles are an invisible form of water or water vapor. Overall, this project will introduce you to a complex engineering concept visually. After your engineer challenge is complete, you can collect observations on your 3-D bubble wand's form and performance.

GRADE LEVELS: K-8

VOCABULARY

Tensile- capable of being drawn out or stretched.

Bubbles- thin spheres of liquid enclosing air or another gas.

Radiation (K-3rd) - energy that moves from one place to another. Examples include light, sound, heat, and X-rays.

Radiation (4th-6th)- emission of energy as electromagnetic waves or as moving subatomic particles. High-energy particles in which cause ionization.

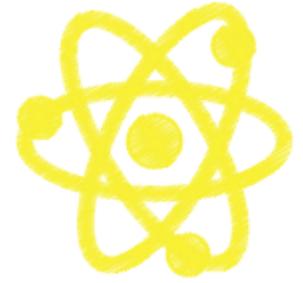
3-D Shapes- a solid figure, object or shape that has three dimensions (length, width, and height).

Structural Engineer- a career that involves math and science to invent, design, build, and care for structures. Examples of a structural engineer's work includes building houses, roads, bridges, dams, or airports.

MATERIALS

- Straws
- Pipe Cleaners
- Bubble Solution
- Bowl or container for bubble solution
- Scissors for cutting straws and pipe cleaners

PROCEDURE



1) *Decide which 3-D shape you would like to model first.*

What 3-D shapes can you find around your house for inspiration?

2) *Next, cut your pipe cleaners and straws evenly to construct your 3-D shape.*

Why should the length of the straws and pipe cleaners be the same and even?

- 3) *Once your straws and pipe cleaners are cut evenly, thread the pipe cleaners through your straws.*
- 4) *Connect your corners or the vertices of your 3-D shape by bending the ends of the pipe cleaners to secure them at the end.*

Why do you place the pipe cleaners through the straws?

- 5) *Connect a pipe cleaner to the top of your 3-D shape as a wand for dipping the 3-D shape in the bubble solution.*
- 6) *Hold the wand and dip your 3-D shape into bubble solution.*

What is happening? What do you notice about how the bubble solution is interacting with your 3-D shape?

7) *For extra fun, try waving your 3-D shape with your wand in the air.*

What happens to your 3-D shape with the bubble solution when you wave it in a slow motion?

- 8) *Try creating another Tensile Bubble by selecting a different 3-D shape to construct.*
- 9) *Record your observations and findings in a journal.*

What do you notice when constructing a different 3-D shape?

Are some 3-D shapes more difficult to construct than others?

When you wave your 3-D shape in the air, does a bubble form when your motions are faster or slower?

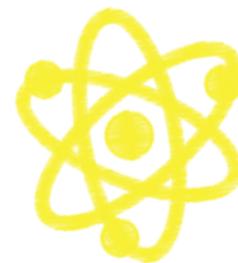
How does the tensile shape help you see the bubble solution more clearly?

THE SCIENCE BEHIND IT

Tensile structures are designed by a material or cable being stretched and held in tension between two or more anchors. Examples of tensile structures are a suspension bridge or the roof of a tent. Creating a 3-D bubble wand or square bubble is like tensile structures. A tensile structure is formed when the soapy solution is stretched between the edges of the wand and the joints that form in the bubble solution.

EXTENSIONS

- *Construct different 3-D shape tensile structures for your bubble wands.*
- *Create homemade bubble solution to try with your 3-D bubble wands.*
- *Make GAK bubbles- watch the resource video below for more information.*
- *Draw pictures of your observations in a science journal to record data on your different bubble experiments and bubble constructions.*



RESOURCES

- *Video on 3-D Bubble Tensile- <https://youtu.be/Y0ZtYNNgUgE>*
- *Video on creating awesome GAK Bubbles- <https://youtu.be/A4QY4hunDdE>*
- *Video on constructing cube bubble- <https://youtu.be/3BG-6MGmvzQ>*
- *INL Video about Radiation Exposure- <https://youtu.be/qJPvpU7gif4>*

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