GYSTC
GEORGIA YOUTH SCIENCE & TECHNOLOGY CENTERS

Title: Bottle Bubble, Bubble Trampoline STEM Challenge

Estimated Time: 1-2 periods

Core Ideas (GSE Standard and elements):

SKP1. Obtain, evaluate, and communicate information to describe objects in terms of the materials they are made of and their physical attributes.

a. Ask questions to compare and sort objects made of different materials. (Common materials include clay, cloth, plastic, wood, paper, and metal.)

b. Use senses and science tools to classify common objects, such as buttons or swatches of cloth, according to their physical attributes (color, size, shape, weight, and texture).

S2P1. Obtain, evaluate, and communicate information about the properties of matter and changes that occur in objects.

a. Ask questions to describe and classify different objects according to their physical properties.

b. Construct an explanation for how structures made from small pieces can be disassembled and then rearranged to make new and different structures.

S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter.

a. Develop and use a model to compare and contrast pure substances (elements and compounds) and mixtures.

Literacy Connections: Books	**Literacy Connections: Close Reads**
Bubble Trouble, Margaret Mahy All About Matter, Mari Schuh	Big Bubbles are Dope – Elementary Big Bubbles are Dope – Middle
Science and Engineering Practices: **Planning and Carrying Out Investigations:** Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. **Constructing Explanations and Designing Solutions:** Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system.	**Crosscutting Concepts:** **Structure and Function:** The way an object is structured/designed determines many of its properties and functions. **Stability and Change:** For designed systems, conditions that affect stability and factors that control rates of change are critical to consider and understand.

STEM Challenge

In this STEM Challenge, your first task is to make a bottle bubble using just the top and bottom of a two-liter bottle. Once you perfect your technique for blowing into the bottle, you can see how big you can make it. Your second task is to make bubble trampoline that can bounce back and forth.

Ask	Ask your students if they've ever blown a square bubble. If possible, blow some bubbles in front of them and ask them to observe closely and appreciate their unique beauty and shape. Here is a real cool video by a bubble artist on Youtube – if you have time, show the first couple minutes https://www.youtube.com/watch?v=wdCiybJeP2w Have students predict what materials they think are found in bubbles. For older students, you could discuss whether they think bubbles are made from a pure substance or a mixture. Mention that, in order to form a bubble, most people use some type of wand (while you wave your wand around).
Imagine/Brainstorm	Students **brainstorm** ideas for how they could design and construct their own bubble wand that could bounce bubble film up and down like a trampoline.
Plan/Design	In order to learn more about the topic, have them read the ***Big Bubbles are Dope*** article and discuss how bubbles can be enhanced to make them stronger and last longer. You can briefly discuss what can be done to enhance bubble solution but remind them that a simple mixture of soap, water, and air works just fine. After completing Part 1 below, have students **plan** and **design** some type of bubble wand that they thing will be capable of producing a bubble trampoline that can bounce up and down without popping. Emphasize that is doesn't have to look like a typical wand and scaffold as needed to get them going.
Create/Test	**Part 1:** To start with, students try to create a bubble bottle by blowing into the top of a two liter bottle that is sitting in bubble solution in the bottom of that same bottle (you cut the top and bottom off earlier so that they could create the rest of the bottle). Model the technique used and direct students not to put their mouth on the top of the bottle but instead blow gently from 1-2 inches away. With a little practice, students get better at forming the bottle bubble by gently blowing air into it. Once they create a bottle shape, they can screw the top on the bottle to stabilize the bottle bubble and prolong its survival. They can also push down to create short bubbles and push up to create ones. Finally, put on some hula music and see if your students can get their bottle bubble to do the hula. This is hularious. https://www.youtube.com/watch?v=EtZ0_bCYtns **Part 2:** Students follow their plan, and **create** a bubble trampoline that can push a bubble film up and down repeatedly. They trampoline should be able to support a film of bubble solution across it. You can make this part more open-ended by letting them choose from a variety of materials like paper plates, bowls, large paper cups, string and straws or you can direct them to use a simple combination of string and straws. Once it is created, students **test** their trampoline in a measureable way to evaluate its effectiveness. Since scientists must have evidence to support their claims, they must measure how well trampoline works in some measureable way. You can decide as a class how to measure them or let each group decide on their own.
Improve	After discussing and evaluating their results, students improve their trampolines and re-test if possible.

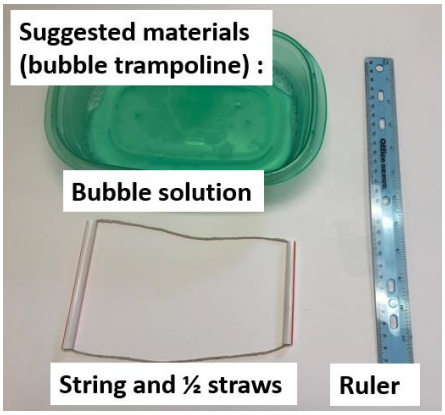
Teacher Notes:
This is a super fun STEM Challenge that kids really love. Bubbles are a **mixture** of **materials** so you can emphasize the materials part or the mixtures part depending on the level of your kids. Bubbles are usually made out of a blend of soap, water, and air. The soap and water form the outside surface of the bubble and the air is trapped on the inside. Bubbles are very delicate and they don't last very long before they pop. They pop as soon as most of the water in the bubble **evaporates**.

If you want to make bubbles that are stronger and last longer, you can add some other materials to the mixture. Glycerin is a gooey **liquid** that you can add to make the soap mixture thicker. Glycerin keeps the water from evaporating as quickly and this helps to make the bubbles tougher and more durable. You can even add a little sugar and baking powder to help even more. But most of the time, a simple mixture of soap, water and air will work just fine. That's all you need for this STEM Challenge.

We start by doing the Bottle Bubble challenge and it takes some practice before students get good at the technique. While blowing gently into the bottle, they should keep their mouths 1-2 inches away from the bottle. After blowing some air into the bottle, they can attach the top and the bubble will become surprisingly stable as the air pressure on both sides is equalized. Encourage them to push the bubble down and then to pull it up gently to see what happens. They can even push the bubbles back and forth swaying in a similar way than dancers doing the hula dance. Some hula music at this point always adds to the fun.

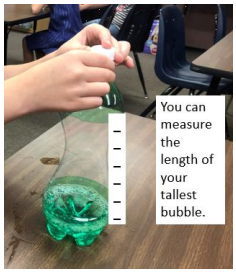
With advanced elementary or middle school students, you may choose to include a discussion why bubbles tend to be spherical. Spherical shapes use a minimal amount of **surface area** to enclose the volume of air that is trapped inside. Surface area is the amount of space that an object occupies on the outside. The less surface area on the outside of an object, the more strong and stable it tends to be.

For the Bubble Trampoline you can let kids use a combination of straws and string or something as simple as a paper bowl or piece of cardboard with the center cut out of it. If you can get bubble film across it, you can turn it into a bubble trampoline. We have our students measure how far the bubble tramp can push away from the center as we want to emphasize the amazing ability of water to attract to itself.



Dawn or Joy detergent both work super well for bubbles. You just need a couple of good squirts per liter of water. Unless you trying to make super big bubbles, there is no need to add glycerin, baking powder or corn starch. Adding them makes the whole production much stickier.

Vocabulary Cards:

mixture a blend of things 	**material** the stuff things are made of 
bubble a mixture of soap, water, and air 	**length** measure from end to end 
liquid a material that can flow 	**engineer** to design, build, and improve things 

Bubble Bottle, Bubble Tramp STEM Challenge:

Can you use a bubble mixture to design, build, and test a bubble bottle and bubble trampoline?

The Bubble Bottle:

1. After learning about bubbles, try blowing a bottle bubble using the materials provided.
2. Practice your technique and see how big of bottle bubble you can blow. Push down to make it short and pull up to make it tall.
3. See if you can get your bubble to sway back and forth and do a Hula dance.

The Bubble Trampoline:

4. **Plan** and **design** a simple trampoline that you think can hold a layer of bubble film and bounce back and forth.
5. Using the materials provided and your plan, **construct** your trampoline.
6. Once the trampoline is constructed, carefully **test** it trying it out to see how it works. Observe and record how it responds.

Evaluating and Improving:

1. As a group, explain how bubbles are a mixture of different materials.

2. As a group, **evaluate** the effectiveness of your design and discuss how you would change your design moving forward to **improve** the performance of your trampoline. If time permits, make these improvements and re-test.