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Bubble Wand Activity

Admin STEM for Success
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3D MODEL A BUBBLE WAND

SUBJECT	TEACHER	GRADE	DATE
Middle School Science	Joya Clark	K-6	2/27/2020

OVERVIEW:

During this project, students will explore the various shapes that a bubble wand can take and the resulting size and number of bubbles produced by various models they design.

OBJECTIVES:

MS-ETS1 Engineering Design

Students who demonstrate understanding can:

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

STANDARDS

Phases	TEACHER ACTIONS	STUDENT ACTIONS
ENGAGE	**Watch the square bubbles video at: https://www.youtube.com/watch?time_continue=32&v=wx0-NrAnE6c&feature=emb_logo** **Ask:** **1.** What can we do to a bubble wand to change the shape of the bubbles? **2.** What causes bubbles to take shape? **3.** What possible shapes can a bubble take?	**After watching the square bubbles video, reflect on the do now questions in your STEM journal.** **This is a good time to ask other students what they think as well. Think about all the bubble wands you have used in the past. Think about which wands made the biggest bubbles, or the most.**

EXPLORE	**Create a Tinkercad account for yourself. Have students create their own accounts. This activity is done best when every student has a device, and their own account. Chromebooks or any device with internet access will work. If that is not possible, groups of 2-3 will work, but you should assign roles. Example: Engineering notebook writer, artist to sketch ideas, and Tinkercad operator.**	**Create an account in Tinkercad and log in. Select a shape for the head of the wand, and then another for the arm. Use your mouse to resize the shapes until you have the dimensions that look right to you.** **Suggestion:** **1. Drag and drop a box onto the workplane** **2. Scale the box to about 100mm x 5mm** **3. Adjust the height of the box to 2mm** **Explore different dimensions and shapes for the head of your bubble wand.**
EXPLAIN	**There are many online tutorials that you should explore before trying this with your students. Try drawing a bubble wand using the steps on this instructables web site: https://www.instructables.com/id/Design-and-3D-Print-a-Bubble-Wand/.** **There are a few things you will need to explain to students to help them get familiar with Tinkercad. Here are a few reminders:** **1.** Right click and drag to move the object around so you can see it from different angles. **2.** Hold down shift to resize the whole shape at the same time. **3.** The little white boxes change individual dimensions separately. **4.** The little black arrow raises and lowers.	**As your teacher demonstrates how to use Tinkercad, jot down the answers to these questions:** **1.** How do I start a new project? **2.** How can I move an object around to see it from all angles? **3.** How do I resize an object all at once, or one dimension at a time? **4.** What is a work plane for and how do I create one? **5.** How do I group or ungroup shapes and why do I need to do that? **6.** How do I export my files to print? **7.** Can I just print the file after I export it or is there something else that needs to be done? **8.** Does my bubble wand come out the same color as on my screen? How do I choose the color?

	5. Press "w" for a new work plane. You have to do this to stack shapes. **6.** The little cube in the top left lets you see from all angles too. Good if you don't have a mouse.	**9.** Can I change my bubble wand if I don't like how it came out? If so, how do I do that? **10.** Do I have to save my work?
ELABORATE	**You can elaborate on this lesson by explaining that water molecules tend to stick together because they are polar (positive and negative ends). This leads to surface tension which draws bubbles (or rain drops, or cells in the body) into spherical shapes. There is an ideal surface area to volume ratio that allows the greatest possible volume in the least possible surface area, and that is common in nature.** **Here is a video to explain: https://www.youtube.com/watch?v=iQigGLdSsUo**	**After your teacher explains surface tension, explain what surface tension is in your STEM notebook. Describe the relationship between surface area, volume, and the shape of a bubble.** **For a challenge, read this lesson and complete the online practice questions: https://www.ck12.org/book/ck-12-biology-advanced-concepts/section/3.5/.**
EVALUATE	**This type of activity is best graded by rubric. Here are some suggestions:** **SCALE: https://scale.stanford.edu/teaching/pact/supporting-documents/single-subjects/rubrics** **Summit Learning Cognitive Skills Rubric: https://cdn.summitlearning.org/assets/marketing/Cognitive-Skills-Document-Suite.pdf**	**Utilize the rubric that your teacher gave you to give yourself a score on the cognitive skills being measured in this activity. What score would you give yourself and why?** **Have another student score your project and provide you with feedback.**

Requirements

- Safety first! Wear your goggles before you blow any bubbles
- You need a Tinkercad account to do this, or some other CAD

Resources

- Extension: https://science-u.org/experiments/square-bubbles.html#experiment-list
- 5E lesson planning: https://wehavekids.c

Notes

This lesson builds upon key concepts in Geometry (surface area), Biology (surface area to volume ratio of cells), Chemistry (electronegativity of oxygen, polarity, adhesion, cohesion, capillarity). It also exposes

software like PTC creo.

- You need a notebook to sketch your ideas.

om/education/How-to-create-a-5-E-Lesson-Plan

- https://www.tinkercad.com/

students to engineering design and stimulates their creativity!