summer activity guide

Invention & Imagination

ages 10–12

G-san
GEORGIA STATEWIDE AFTERSCHOOL NETWORK

50 STATE AFTERSCHOOL NETWORK

VPOST
VIRGINIA PARTNERSHIP FOR OUT-OF-SCHOOL TIME

About the Summer Activity Guides

Summers are for fun and engaged learning. In 2020 as the impact of the pandemic is widely felt, summer opportunities will be different for young people, families, and afterschool and summer program staff. The Summer Activity Guides were developed to help engage youth with supportive adults in a range of places.

The activities and resources in the Summer Activity Guides are intentionally designed to support youth-serving summer programs in driving consistent engagement and providing ongoing opportunities for youth skill-building and emotional well-being. In addition to the activities for youth, supplemental materials will be available to support professional development and enhance family engagement.

The Guides include 150 original activities and challenges organized by four different age groups (5-9) (10-12) (13-15) (16-18). The activities are adaptable for in-person and virtual instruction, or a hybrid of both, as well as sent as take-home packets.

All activities should be safely executed and aligned with state and local health guidelines.

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Marshmallow & Toothpick Geometry

ACTIVITY DESCRIPTION

In this STEM activity, youth will build geometric shapes using toothpicks and marshmallows. As part of the 'Invention & Imagination' unit, this hands-on math activity is designed to help youth explore 3-dimensional structures. This activity encourages the development of basic geometry skills, problem-solving skills, and creativity.

SUPPLIES

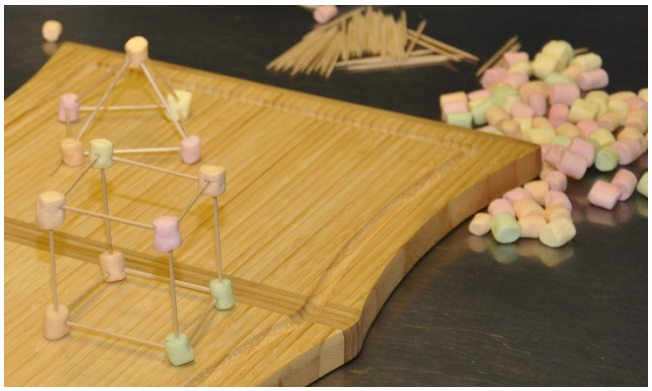
- 150 toothpicks
- 100 small marshmallows
- Copy of the '3D Geometric Shapes with Marshmallows and Toothpicks' available here: https://members.teachbesideme.com/wp-content/uploads/2017/06/Marshmallows-and-Toothpicks-book.pdf

STEPS

- Today you are going to try to build 3-dimensional shapes using marshmallows and toothpicks. A 3-dimensional shape is an object that has length, width and height. For some examples of 3-dimensional shapes, see: https://www.math-salamanders.com/image-files/3d-geometric-shapes-assorted-col.gif
- Set out your marshmallows and toothpicks. Look at the 'Build 3D Geometric Shapes' Activity Cards. Each card shows you how many marshmallows and how many toothpicks you will need to build the shape.
- Find the first card, 'Build a Tetrahedron'. The card shows that you will need 4 marshmallows and 6 toothpicks to make a tetrahedron. Use your marshmallows and toothpicks to try to make a square, just like the picture on the card.
- *Does your shape look like the picture on the card?* After you have finished, set that shape aside and pick up the next card and try to build the shape in the picture.
- See if you can build all 12 shapes on the 3D cards.

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you.
- If you are delivering the activity digitally, have youth share photos of their shapes on your program platform or page.



EXTENSIONS

- Try building a shape or a structure that can hold weight. What shape can hold the most weight?
- Try building the tallest structure you can. How tall can you make it without it tipping over?
- Try doing the 'Famous Towers' challenge in this unit by using only marshmallows or toothpicks.

QUESTIONS FOR DISCUSSION

- What was your favorite part of the activity and why?
- What challenged you the most?
- What shapes were new to you?
- [Pick a few of the shapes and discuss:] What real-life buildings or structures have you seen that are this shape? Why do you think that they are this shape?
- What other shapes, that were not on the cards, could you build?

CREDITS: Teach Beside Me's 'Building 2D and 3D Geometric Shapes with Marshmallows and Toothpicks' available at https://members.teachbesideme.com/wp-

Famous Towers

CHALLENGE DESCRIPTION

In this STEM challenge, youth will use household items to create five famous towers. As part of the 'Invention & Imagination' unit, this challenge is designed to introduce youth to structural engineering. This activity encourages the development of STEM literacy, problem solving, and critical thinking

SUPPLIES

- You can use a lot of different types of items for this challenge. Here are some ideas:
  - Popsicle sticks or toothpicks
  - Straws
  - Spaghetti (dry)
  - Cups
  - Newspaper or Cardboard
  - Marshmallows
  - Legos or other blocks
  - String or tape
- Famous Towers Handout

STEPS

- A tower is a building that is taller than its length and width. You have probably built towers before, but have you ever wondered why some towers are stronger or taller than others?
- In this challenge, you will create 5 towers that are different shapes and use different materials. Each day you will create a tower that looks like a famous tower from the list below, or you may pick your own famous tower. Check out the Handout for photos of each.
  - **Day 1: CN Tower –** The CN Tower is located in Toronto, Canada. It is 1,815 feet tall and was the tallest building in the world for 30 years.
  - **Day 2: Eiffel Tower** – The Eiffel Tower is located in Paris, France. It is 984 feet tall and more than 200 million people have visited this tower.
  - **Day 3: Burj Khalifa** – The Burj Khalifa is located in Dubai, United Arab Emirates. It is the tallest building in the world (2,717 feet)
  - **Day 4: The Minaret of Samarra** – A minaret is a tower. The Spiral Minaret is located in Samarra, Iraq. It is shaped like a cone and has a spiral ramp.
  - **Day 5: Leaning Tower of Pisa** – The Pisa Tower is located in Pisa, Italy. After it was built, it began to sink because of poor construction.
- For each tower, copy the design of the tower as best you can.
- After you build the tower, ask yourself: what part of the design made your tower stronger?

ADAPTATIONS

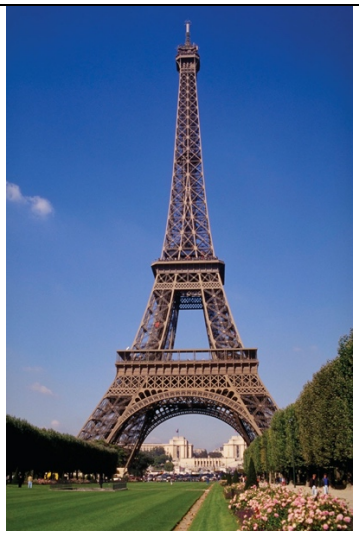
- If you are delivering the activity virtually, send home a kit with the challenge supplies so that youth are all able to participate (e.g., popsicle sticks, straws, spaghetti, cups, cardboard, marshmallows, string or tape.) Have youth share out examples of their towers.
- If you are delivering the activity via take-home packets or digitally, encourage youth to upload photos of their towers.

EXTENSIONS

- Test each tower to see which one will knock over when you blow it or push it lightly. What can you do to make it stronger?
- Design your own tower. Try to build a stronger or taller tower using what you learned from the challenge. Draw the tower on a piece of paper before building it – just like real engineers do!
- If you have a deck of cards at home, try to build a house of cards (https://www.flickr.com/photos/63417360@N02/7933021762)

Famous Towers Handout

Instructions: Each day create a tower that looks like a famous tower from the list below, or you may pick your own famous tower.

Day 1: CN Tower	Day 2: Eifel Tower	Day 3: Burj Khalifa
		
Day 4: The Minaret of Samarra	**Day 5: Leaning Tower of Pisa**	**Create Your Own Tower**

Build a Catapult

ACTIVITY DESCRIPTION

In this STEM activity, youth will build their own catapult using Popsicle sticks and use it to fire small objects. As part of the 'Invention & Imagination' unit, this engineering and physics experiment is designed to get youth excited about simple machines and introduce them to a law of motion. This activity encourages the development of STEM literacy, inquiry, creativity and critical thinking skills.

SUPPLIES

- 10 jumbo Popsicle sticks
- 5 rubber bands
- Plastic spoon
- Marshmallows, erasers, pom poms or other small objects
- Build a Catapult Handout
- [Optional] Catapult Log Handout
- [Optional] Measuring tape

STEPS

- Take 8 Popsicle sticks and stack them on top of one another. Wrap a rubber band around each end of your stack. See step 1 on the handout.
- Take another one of your sticks and push it through the stack just below the top stick. See step 2 on the handout. Here is a video of how to do this: https://littlebinsforlittlehands.com/popsicle-stick-catapult-kids-stem-activity/?jwsource=cl
- Flip your stack over so that the Popsicle stick that you just pushed through is on the bottom of the stack.
- Put a second stick on top of your stack and wrap a rubber band around the bottom of the 2 Popsicle sticks. See step 3 on the handout.
- Place your spoon, facing up, on top of the stick that is on top. Wrap a rubber band around the bottom to attach the spoon to the stack and another rubber band around the top. See step 4 on the handout.
- Push the stack of Popsicle sticks towards the ends connected by the rubber bands.
- Your catapult is complete! Now try it out. Hold a marshmallow (or other small object) in the scoop of the spoon. Press down on the spoon and then let go. Watch your marshmallow shoot into the sky!
- Try shooting each of your small objects from your catapult to see which one goes the farthest. Use the Catapult Log Handout to record the distances.

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you.

EXTENSIONS

- Use a measuring tape to see which items flew the farthest. Measure and record the launches in a log.
- Try designing a different catapult using the same materials.
- Test out the number of Popsicle sticks used in the stack, what happens if you use 6 or 10 instead of 8?
- Try making 2-3 different catapults out of different materials. See which one works better. Here's how to make a Lego catapult: https://littlebinsforlittlehands.com/easy-lego-catapult-and-tension-experiment-for-kids/ and here is how to make a catapult with toothpicks https://littlebinsforlittlehands.com/easy-marshmallow-catapult-activity/

QUESTIONS FOR DISCUSSION

- A catapult is a simple machine. What type of machine is it? It's a lever.
- What other examples of levers can you think of?
- How does a lever work? When you pull down on the arm of the lever, all of the energy gets stored up and then when you release it, the energy that has been stored up shoots the object into the air. This is called Newton's Law of Motion.
- Which item will go the farthest? Why do you think that item will go the farthest? Come up with a hypothesis (a guess).
- Try firing different objects. Which item worked the best? Did any objects not work at all? Why?

CREDITS: Little Bins for Little Hands' 'Popsicle Stick Catapult' available at https://littlebinsforlittlehands.com/popsicle-stick-catapult-kids-stem-activity/

Build a Catapult Handout

Step 1: Take 8 Popsicle sticks and stack them on top of one another. Wrap a rubber back around each end of your stack.

Step 2: Push one of the sticks with notches through the stack just below the top stick.

Step 3: Put a second stick on top of your stack and wrap a rubber band around the bottom of the 2 Popsicle sticks.

Step 4: Place your spoon, facing up, on top of the stick that is on top. Wrap a rubber band around the bottom to attach the spoon to the stack and another rubber band around the top.

Catapult Log Handout

Instructions: Try shooting each of your small objects from your catapult to see which one goes the farthest. Measure and record the distance that each object travelled using the below log.

Catapult test #	Distance travelled (in inches)
1	
2	
3	
4	
5	
6	
7	
8	

Fizzy Painting

ACTIVITY DESCRIPTION

In this art and STEM activity, youth will create a 'fizzy painting'. As part of the 'Invention & Imagination' unit, this experiment is designed to introduce youth to chemical reactions. This activity encourages the development of inquiry, creativity and critical thinking skills.

SUPPLIES

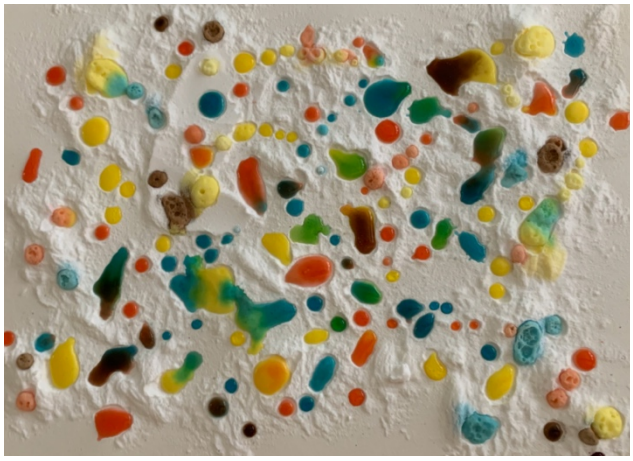
- Watercolor paper (or use a thick, heavy paper)
- ½ cup of baking soda
- Vinegar (less than ½ cup)
- A squeeze bottle / recycled condiment bottle (ex. an old mustard bottle) / pipette
- Food coloring (multiple colors)

STEPS

- In this activity, you will create a chemical reaction by making a fizzy painting. A chemical reaction is when two or more ingredients are mixed together and then each ingredient breaks apart into smaller pieces to form something new.
- Find a space where it's okay to get a little messy or somewhere that is easy to clean.
- Sprinkle ½ cup of baking soda on watercolor paper.
- Add 1 tablespoon of vinegar to your squeeze bottle or pipette.
- Add 2 – 3 drops of food coloring to the squeeze bottle or pipette.
- Use the squeeze bottle or pipettes to drop the colored vinegar onto the watercolor paper.
- Wash out or use a different squeeze bottle or pipette. Add a different color. Repeat until you are finished with your painting.
- Once your paper has dried, scrape off the leftover baking soda.
- You just saw a chemical reaction between baking soda and vinegar. When you added the vinegar, it created the fizzy reaction and formed a gas and a liquid.

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you. If you are not able to send home the supplies, youth can watch the facilitator do the demonstration. Be sure to pause throughout for questions and discussion.
- If you are delivering the activity via take-home packets or digitally, encourage parents or caregivers to be involved so that youth can discuss the questions and their observations with someone.



EXTENSIONS

- Do the experiment over again, but this time change one part (variable) of the experiment. For example, what happens when you add more or less baking soda?
- Try another chemical reaction. Make rainbow lightning art using magnets. Find out how to do it here: https://taminglittlemonsters.com/rainbow-lightning-process-art-for-kids/. Or, try 'Water and Oil Droplet Paintings', like the one found here: https://stayathomeeducator.com/oil-and-water-droplet-painting-process-art-activity/

QUESTIONS FOR DISCUSSION

- What do you think will happen when you add vinegar to the baking soda? What is your hypothesis (guess)?
- What happens to the paper? Why do you think this happened?
- What happened when you mixed the colors?

CREDITS: Taming Little Monsters', 'Fizzy Painting' available at https://taminglittlemonsters.com/fizzy-painting-stem-activity-for-kids/

Chromatography

ACTIVITY DESCRIPTION

In this STEM activity, youth will use everyday objects to conduct a simple chemistry experiment. As part of the 'Invention & Imagination' unit, this activity is designed to introduce youth to the process of chromatography. This activity encourages the development of STEM literacy, inquiry and critical thinking skills.

SUPPLIES

- Black washable marker (black Crayola washable or black Expo)
- 1 paper towel
- Scissors
- 5 cups
- Water
- Piece of paper
- Chromatography Handout

STEPS

- Chromatography is the process that scientists use to separate mixtures by letting them slowly move past each other.
- Cut your paper towel into 5 strips (long pieces). See step 1 in the handout.
- Use your black marker to color the center of each strip of paper towel (about the size of a quarter or 1 inch). See step 2 in the handout.
- Put a small amount of water in the bottom of each of your 5 cups (about 1 inch of water). See step 3 in the handout.
- Fold each of your 5 strips of paper towel in half with the part that you colored at the fold.
- Put 1 piece of paper towel in each cup with the colored center in the water. Let the ends of the strips hang over the sides of the cups. See step 4 in the handout.
- Watch what happens!
- Let the paper towels stay in the cups for a few minutes. Then, take them out and lay them flat on a piece of paper to dry. See step 5 in the handout.
- Look at your paper towels. What colors is black ink made of?

CREDITS: Babbledabbledo's 'The Classic Chromatography Experiment' available at https://babbledabbledo.com/how-to-do-the-classic-chromatography-experiment/

ADAPTATIONS

- If you are delivering this activity digitally, create a log on your program page where youth can post their observations.
- If you are delivering the activity via take-home packets or digitally, encourage parents or caregivers to be involved so that youth can discuss the questions and their observations with someone.

EXTENSIONS

- Try this same experiment with other marker colors or other types of liquid.
- Try this experiment with a permanent marker (like a Sharpie) instead of a washable marker. Once you have colored the paper towel with the marker, add a few drops of rubbing alcohol. Watch what happens.
- Try this same experiment using a coffee filter: https://www.exploratorium.edu/science_explorer/black_magic.html

QUESTIONS FOR DISCUSSION

- What did you think was going to happen when you put the paper towel in the cup of water?
- What happened?
- What surprised you?
- Why do you think that the water separated the colors on the paper towel?
- How could this process be useful?

Chromatography Handout

Step 1: Cut your paper towel into 5 strips (long pieces).

Step 2: Use your black marker to color the center of each strip of paper towel.

Step 3: Put a small amount of water in the bottom of each of your 5 cups (about 1 inch of water).

Step 4: Put a small amount of water in the bottom of each of your 5 cups (about 1 inch of water).

Step 5: Let the paper towels stay in the cups for a few minutes. Then, take them out and lay them flat on a piece of paper to dry.

Look at your paper towels. What colors is black ink made of?

Tie-Dye T-Shirt

ACTIVITY DESCRIPTION

In this STEM and art activity, youth will create a tie-dye t-shirt using permanent markers and rubbing alcohol. As part of the 'Invention & Imagination' unit, this experiment is designed to introduce youth to soluble science. This activity encourages the development of inquiry, creativity and critical thinking skills.

SUPPLIES

- 1 plain, white cotton t-shirt
- 1 piece of cardboard (about the size of a piece of printer paper)
- Permanent markers (different colors)
- Rubbing alcohol
- Eyedropper / pipette / or recycled condiment bottle

STEPS

- [Note: This activity uses rubbing alcohol, which is can be harmful if ingested. You will need an adult to help.]
- Have you noticed when water drops on paper with words on it, sometimes the ink runs? This is because the ink has combined with the water, and as the water moves it carries the ink with it. This is called "solubility". In this activity, we will learn more about solubility by making tie-dye t-shirts.
- To create your tie-dye t-shirt, insert a piece of cardboard into the t-shirt to prevent the colors from bleeding through to the other side.
- Pick the permanent marker colors you want to use.
- Use your markers to draw small simple patterns all over your shirt. For example, to make a flower you can make a large dot in one color and then smaller dots around the large one in a different color. Or you can draw a heart of fireworks shapes.
- Ask an adult to add rubbing alcohol to the eyedropper.
- Slowly drip the rubbing alcohol onto the center of your design.
- Once you have finished designing your t-shirt. Let it dry completely. (Note: Ask an adult to iron your shirt or throw it in the dryer to make sure the design stays put.)

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you.
- If you are delivering the activity via take-home packets or digitally, encourage youth to upload photos of their design on your organization's online platform or social media.

EXTENSIONS

- To create other chemical reactions, try the 'Fizzy Dough' or 'Fizzy Painting' activities and extensions.
- If you have an extra t-shirt, try it again. This time draw something new with your permanent markers and/or change how much rubbing alcohol you use.
- Try using a different piece of clothing or cloth, like a mask, sock or kitchen towel.
- Make a shirt for a loved one and invite your whole family to participate.

QUESTIONS FOR DISCUSSION

- How far did the color spread when you dropped alcohol on it? What did that mean for your design?
- What happened to your design when you added 1 drop? What happened when you added more drops?
- When the colors mix together, what happens?
- Do you think water would work as well as rubbing alcohol? Why or why not? (Probably not, water does not create the same chemical reaction with permanent markers as alcohol does.)

CREDITS: Playdough to Plato's 'Sharpie Tie-Dye Science' available at: https://www.playdoughtoplato.com/sharpie-tie-dye-science/

Make It Bounce

ACTIVITY DESCRIPTION

In this STEM activity, youth will create bouncy balls. As part of the 'Invention & Imagination' unit, this experiment is designed to introduce youth to polymer science and chemical reactions. This activity encourages the development of STEM literacy, inquiry and critical thinking skills.

SUPPLIES

- 2 tablespoons of white glue
- 2 tablespoons of warm water
- 2 teaspoons of cornstarch
- 1 teaspoon of Borax
- Food coloring
- 2 cups, 2 spoons, and measuring spoons

STEPS

- [Note: This activity uses Borax, which is an eye irritant. You will need an adult to help.]
- In this activity, we are going to make our own polymer. Polymers are big molecules made of smaller molecules that are stuck together like blocks. (Think of a chain of paper clips.) A molecule is the smallest material that can exist. Paper, plastic and gum are all polymers.
- To make a polymer, first, get out 2 cups.
- In your first cup, mix 1 teaspoon of Borax with 2 tablespoons of warm water. Stir until the Borax is part of the water (dissolved). (Note: wash your hands after using Borax)
- In your second cup, mix 2 tablespoons of white glue with 2 teaspoons of cornstarch. Add 2 -3 drops of food coloring and stir together.
- Add your mixture from the first cup (dissolved Borax) to the second cup (glue/cornstarch). Stir together.
- Once the mixture becomes impossible to stir, take it out of the cup and mix it together with your hands (like a pizza dough). After mixing, roll it between your palms to make a ball. Make sure to keep pushing hard. (Note: this will be messy, and that's the fun part!)
- Now your ball should be ready to bounce.

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you.
- If you are delivering the activity via take-home packets or digitally, encourage parents or caregivers to be involved so that youth can discuss the questions and their observations with someone.

EXTENSIONS

- Try the activity again using more or less of one ingredient. For example, add more glue to see if your ball is bouncier.
- Try a different experiment using a different kind of polymer – a gummy bear! In this experiment you will see what happens to gummy bears when you mix it with water. Here is the activity: https://www.pslc.ws/macrog/kidsmac/activity/bear.htm

QUESTIONS FOR DISCUSSION

- What did you think would happen when you mixed your first cup with your second cup?
- Why do you think the ball bounces? (The ball bounces because the polymer chain changes shape when it hits the floor, which makes it bouncy.)
- Does it bounce better on carpets or hard surfaces?
- What other polymers can you think of that are bouncy and stretchy? What do they have in common?

CREDITS: Babbledabbledo's 'DIY Bouncy Balls' available at https://babbledabbledo.com/simple-science-experiment-diy-bouncy-balls/

Lava Lamps

ACTIVITY DESCRIPTION

In this STEM activity, youth will create a layered 'lava lamp'. As part of the 'Invention & Imagination' unit, this experiment is designed to introduce youth to the density of liquids. This activity encourages the development of STEM literacy, inquiry, creativity and critical thinking skills.

SUPPLIES

- Large jar or bottle (e.g., soda bottle)
- Cookie sheet
- ¼ cup of corn syrup
- ½ cup of water
- Food coloring
- ½ cup of oil
- Measuring cups
- 1 Alka Seltzer tablet
- [Optional] Scientific Method sheet to record the steps and observations of the experiment: https://docs.google.com/file/d/0Bxq0hYp2IyG1QWVzQTIycG1KbGs/edit?pli=1

STEPS

- [Note: this activity includes an Alka Seltzer tablet and is best done with adult supervision and support.]
- Set your cookie sheet out on a table and place your jar in the middle of it. This will help with anything that may spill.
- Measure about ¼ cup of corn syrup and pour it into the jar.
- Measure about ½ cup of water and add it to your jar.
- Add 3 drops of food coloring.
- Measure ¼ cup of oil and add it to the jar. If your jar is not very full, you can add another ¼ cup of oil. Leave a little room at the top of your jar.
- Add 1 Alka Seltzer tab to your jar. Watch what happens! It creates bubbles like a lava lamp.
- Put the top back on your jar.

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you.

EXTENSIONS

- Use different liquids to make another jar. Try using honey, light corn syrup, dish soap, olive oil, rubbing alcohol and water. Which liquids are denser and go to the bottom of the jar and which are less dense and stay near the top of the jar?
- Try making a rainbow density jar. Check out the following link for a step-by-step: https://www.playdoughtoplato.com/rainbow-jar/

QUESTIONS FOR DISCUSSION

- What do you think will happen when you add the different liquids to the jar? What is your hypothesis (guess)?
- What happens when you add liquids to your jar? They are separating and becoming layered in the jar.
- Why do you think the liquids are separating and becoming layered? The liquids separate because they have different weights. Density describes how heavy a liquid is.
- What other liquids might have different densities?
- What happened when you added the Alka Seltzer tablet? Why do you think that happened? When you added the tablet, it started dissolving and creating a gas.

CREDITS: Babbledabbledo's 'How to Do the Classic Layered Liquids Science Project' available at https://babbledabbledo.com/science-for-kids-layered-liquids/

Cloud in a Jar

ACTIVITY DESCRIPTION

In this STEM activity, youth will create a cloud in a jar. As part of the 'Invention & Imagination' unit, this experiment is designed to introduce youth to the science of weather and condensation. This activity encourages the development of STEM literacy, inquiry and critical thinking skills.

SUPPLIES

- A jar with a lid
- 1/3 measuring cup
- 1/3 cup of hot water (from the tap)
- Ice (5 – 7 cubes of ice, or enough to fill the lid of a jar)
- Hairspray
- Cloud in a Jar Handout

STEPS

- Have you ever looked up in the sky and wondered how clouds form? Clouds form when water in the air condenses. Condensation is the process of a gas changing into a liquid. In this activity, you will make your own cloud using a jar.
- Add 1/3 cup of hot water from the sink into the jar with a lid. Swirl it around in the jar to warm up the sides.
- Turn the lid upside down and place it on top of the jar.
- Add 5-7 ice cubes onto the lid and allow the ice to rest on the top of the jar for 20 seconds.
- Remove the lid, quickly spray a small amount of hairspray into the jar, and then replace the lid with the ice still on top.
- When you see a good amount of condensation (gas changing into a liquid) in the jar, remove the lid.
- When you added the warm water to the jar, some of it turned into vapor. Then, the vapor rose to the top of the jar, and it came into contact with the cold air from the ice cubes. When the vapor cooled, it also condensed. The cloud formed when you gave the condensation something to hold on to: hairspray! In nature, water vapor condenses with dust, air pollution, pollen, or other small particles in the air.

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you. If you are not able to send home the supplies, youth can watch the facilitator conduct the experiment. Be sure to pause throughout for questions and discussion.
- If you are delivering the activity via take-home packets or digitally, encourage parents or caregivers to be involved so that youth can discuss the questions and their observations with someone.

EXTENSIONS

- Do the experiment over again, but this time change one part of the experiment. For example, what happens when you add more or less water, or use a smaller or bigger jar?
- Create a raincloud in a jar. Follow the instructions here: https://www.giftofcuriosity.com/make-a-rain-cloud-in-a-jar/

QUESTIONS FOR DISCUSSION

- Why do you think you added warm water then cold ice to the top of the jar?
- What happened inside the jar when the lid was on? (The water vapor rose to the top of the jar.)
- What happened when you removed the lid? Why do you think this happened? (The water condensed with hairspray and formed a cloud.)
- Where else have you seen condensation before (ex. bathroom mirror after a shower)?

CREDITS: Gift of Curiosity's 'Weather Science' available at https://www.giftofcuriosity.com/weather-science-how-to-make-a-cloud-in-a-jar/

Cloud in a Jar Handout

Step 1: Add 1/3 cup of hot water into the jar with a lid. Swirl it around in the jar to warm up the sides. Turn the lid upside down and place it on top of the jar. Add 5-7 ice cubes onto the lid and allow the ice to rest on the top of the jar for 20 seconds.

Step 2: Remove the lid, quickly spray a small amount of hairspray into the jar, and then replace the lid with the ice still on top.

Step 3: When you see a good amount of condensation (gas changing into a liquid) in the jar, remove the lid.

Lemon Volcano

ACTIVITY DESCRIPTION

In this STEM activity, youth will use a lemon to make a volcano that erupts. As part of the 'Invention & Imagination' unit, this chemistry experiment is designed to build wonder and excitement while introducing youth to a chemical reaction that creates carbon dioxide. This activity encourages the development of STEM literacy, inquiry, creativity, and critical thinking skills.

SUPPLIES

- 2 lemons cut in half
- ½ cup baking soda
- Food coloring
- Dawn dish soap
- Plate or tray
- Small cup
- Spoon
- Lemon Volcano Handout

STEPS

- [Note for adults: Cut both lemons in half.]
- Squeeze 2 of your lemon halves into a small cup so that you have extra lemon juice.
- Place half a lemon on a plate or a tray. This will prevent a mess when the volcano erupts.
- Use the handle of your spoon to poke holes in the different sections of the lemon. See step 1 on the handout.
- Put a few drops of food coloring around the different sections of the lemon. You can use just one color or different colors. See step 2 on the handout.
- Pour some Dawn dish soap over the top of the lemon. See step 3 on the handout.
- Use a spoon to sprinkle baking soda over the top of the lemon. See step 4 on the handout. Save a little bit of your baking soda to add later. You can also use the handle to push some of the baking soda into sections of the lemon to help your eruption along.
- It will take a few minutes for the reaction to begin and your volcano to start to erupt.
- As it begins to erupt, you can use the handle of your spoon to push more the baking soda into the lemon more.
- After the first eruption has stopped, you can add more baking soda and pour your extra lemon juice on top to continue the reaction.

CREDITS: Little Bins for Little Hands' 'Erupting Lemon Volcano' available at https://littlebinsforlittlehands.com/erupting-lemon-volcano-chemistry/

ADAPTATIONS

- If you are delivering the activity virtually, send home a kit with the activity supplies so that youth are all able to participate in the experiment alongside you. If you are not able to send home the supplies, youth can watch the facilitator do the demonstration. Be sure to pause throughout for questions and discussion.

EXTENSIONS

- Try doing the same experiment with other citrus fruits like limes, oranges, and grapefruits. Which fruit has the biggest eruption?
- Work in groups to research the causes, composition, types of volcanoes and the impact of their eruptions. Then build a volcano with your group.
- For a number of lessons on volcanos, check out: https://www.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.lp_volcanoes/volcanoes/
- Check out the short film 'Working as a Volcanologist': https://www.youtube.com/watch?v=ADnh2FcZwLg
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QUESTIONS FOR DISCUSSION

- What do you think will happen when you add the dish soap and baking soda to the lemon? Come up with a hypothesis (a guess).
- What happened when you added the baking soda to your lemon? Why do you think that happened?
- What surprised you?
- What made the lemon volcano erupt? The citric acid from the lemon juice reacts with the baking soda and creates carbon dioxide, which is a gas. The bubbling and fizzing that you see is the carbon dioxide.
- What did you like about the activity?
- What challenged you?
- What do you want to learn more about?

Lemon Volcano Handout

Step 1: Use the handle of your spoon to poke holes in the different sections of the lemon.

Step 2: Put a few drops of food coloring around the different sections of the lemon. You can use just one color or different colors.

Step 3: Pour some Dawn dish soap over the top of the lemon.

Step 4: Use a spoon to sprinkle baking soda over the top of the lemon.

The 50 State Afterschool Network

The Summer Activity Guide has been developed for the 50 State Afterschool Network with leadership from the Georgia Statewide Afterschool Network to engage and support children and youth nationwide.

In each state, the afterschool network is broadening opportunities for youth. Seeking equitable outcomes for underserved children to succeed in school and future jobs, a statewide afterschool network brings together cross-sector leaders with a common vision and coordinated strategy to advance quality afterschool and summer learning programs

Alabama Afterschool Community Network
Alaska Afterschool Network
Arizona Center for Afterschool Excellence
Arkansas Out of School Network
California AfterSchool Network
Colorado Afterschool Partnership
Connecticut After School Network
Delaware Afterschool Network
Florida Afterschool Network
Georgia Statewide Afterschool Network
Hawai'i Afterschool Alliance
Idaho Afterschool Network
Afterschool for Children and Teens Now (ACT Now) Coalition (IL)
Indiana Afterschool Network
Iowa Afterschool Alliance
Kansas Enrichment Network
Kentucky Out-of-School Alliance
Louisiana Center for Afterschool Learning
Maine Afterschool Network
Maryland Out of School Time Network
Massachusetts Afterschool Partnership
Michigan After-School Partnership
Ignite Afterschool (MN)
Missouri AfterSchool Network
Mississippi Statewide Afterschool Network
Montana Afterschool Alliance
Beyond School Bells (NE)
Nevada Afterschool Network
New Hampshire Afterschool Network
New Jersey School- Age Care Coalition
NMOST (New Mexico Out of School Time) Network
New York State Network for Youth Success
North Carolina Center for Afterschool Programs
North Dakota Afterschool Network
Ohio Afterschool Network
Oklahoma Partnership for Expanded Learning Opportunities
OregonASK
Pennsylvania Statewide Afterschool/Youth Development Network
Rhode Island Afterschool Network
South Carolina Afterschool Alliance
South Dakota Afterschool Network
Tennessee Afterschool Network
Texas Partnership for Out of School Time
Utah Afterschool Network
Vermont Afterschool, Inc.
Virginia Partnership for Out-of-School Time
Washington Expanded Learning Opportunities Network
West Virginia Statewide Afterschool Network
Wisconsin Afterschool Network
Wyoming Afterschool Alliance