Caretaker Guide to Participating in the STEM + Families Science Festival Program at Home

Festival Weeks April 5th-15th

This guide will help you lead your family through these Science Festival activities. You can give the "Student Guides" to your children to do alongside you (they're more like worksheets!)

Program Goals

- Make real-world connections with STEM principles like problem-solving and critical thinking.
- Inspire your family to explore interests and potential careers in STEM.
- Give your family access to STEM activities you can do at home.

Table of Contents

Frequently Asked Questions for Caretakers

What is included in this guide?
In this guide, you will find resources to use as you facilitate this event and the experiments for your family. Each experiment has vocabulary to use, materials needed, instructions to follow and videos you can watch if you have access to the internet. However, this is not necessary! All the information you need is in this guide.

After you have conducted the experiment, you can have a family discussion using the "expand your knowledge", "real world application questions" and the grade level questions. The grade level questions are broken up into K-2 and 3-5. For older students, these questions are still relevant! Just encourage them to dig deeper in the level of detail they give in their responses. We have provided suggested answers to all of the questions. Finally, there is a Student Guide handout for your children to use to follow along. In the handout, you will find blank space for your children to write what they have learned and to answer the questions.

How should I facilitate this program for my family?
This program is an opportunity for your family to engage in fun STEM experiments. It is a hands-on event with four different experiments. The goal of the program is to experiment, learn about STEM and increase awareness of STEM education and careers. The four experiments are hands-on and require materials that you most likely have at home.

April 5th-April 15th Festival Week

Do I do all of the experiments at one time?
That is up to you. Each experiment can be done on its own and should take about 15-20 minutes. You can decide, as a family, if you would like to do all of the experiments at one time or over multiple days. In addition, you can select which of the experiments you and your family would like to do. You do not have to do all four of them.

Do I let my child conduct the experiments?
Each experiment is made for children and students to conduct. In the instructions, there are recommended roles for adults and students, but the most important thing is for you and your children to do it together!

How long will each experiment take?
Each experiment is about 10-15 minutes long.

How do I share pictures/videos of my family participating?
While you are conducting the experiments, make sure to take lots of pictures and videos. You have a few options for sharing these pictures/videos. You can email them to your local PTA—if you choose this option, you must also send a signed media release form. This allows the PTA to share these pictures/videos publicly and with National PTA. Or you can post the pictures/videos on social media and tag your PTA—in this case, you don't need to submit a signed media release form for your PTA to be able to share them publicly and with National PTA.

How can I share other feedback?

You are asked to complete a participant survey to share your experience and help both your local PTA and National PTA improve these types of programs. If you have internet access (on the computer or mobile device), complete the survey at PTA.org/Survey. Or, you can complete a paper survey provided by your PTA.

Materials Needed

Alka Rockets	• Empty film canister • Glass of water • Effervescent antacid tablets
Bubbling Lava Lamp	• Water • A clear plastic bottle with cap • Vegetable oil • Food coloring • Effervescent antacid tablets

Martian Jelly 	• 1 tablespoon grape jelly • 1/8 teaspoon baking soda (not baking powder) • 1 tablespoon vinegar • 1/2 cup of warm water • Popsicle stick to stir solution
Sticky Icky 	• White school glue • Food coloring (various colors) • Borax (found in the laundry aisle) • Two pitchers: One labeled “Borax Solution,” one labeled “Water Only” • Warm tap water • Plastic Tablespoons (some for water, some for glue) • Plastic Teaspoons (for Borax solution) • Six-ounce plastic cups (one for each student-adult pair) • Popsicle sticks (one for each student-adult pair) • Safety glasses

What is STEM?

If you have access to the internet, you can watch the video at PTA.org/STEM. Or you can use the talking points below to talk to your family about STEM. First, ask your children to tell you what they know about STEM.

- STEM = Science, Technology, Engineering and Mathematics.
- STEM careers in the United States are growing faster than other professions.
- The demand for qualified professionals is high, but the supply of workers to fill these positions is low—especially among women, minorities and students from low-income families.
- Not all STEM careers require a four-year degree; many well-paid careers are accessible with a two-year degree or certificate.

Activating Question

Question: What makes a rocket lift off?

Possible answer: A rocket can lift off from a launch pad only when it expels gas out of its engine. The rocket pushes on the gas, and the gas in turn pushes on the rocket. With rockets, the action is the expelling of gas out of the engine. The reaction is the movement of the rocket in the opposite direction.

Alka Rockets

<table>
<tr><th colspan="2">Experiment: Alka Rockets</th></tr>
<tr><td>Vocabulary

Chemical reaction: What happens when two substances combine to make something new.

Phase change: When enough energy is added or taken away from an object that it moves from a solid, liquid, gas phase to another phase.

Pressure: The amount of force applied on an object.</td><td rowspan="2">Directions

Adult and student: After you're outside, put on your safety glasses.

Student: Pour approximately ½ inch of water into the film canister. Make sure to fill the film canister one-half full of water and not more than that.

Adult and student:
• Break the effervescent antacid tablet in half.
• Put one half of the tablet into the film cannister.
• Quickly put the lid on the cannister, make sure the seal is tight.

Student: Shake the canister vigorously, turn it upside down and place it on a flat surface or on the ground (on its lid).

Adult and student: Step back a few feet! Wait and watch the film canister rocket launch.</td></tr>
<tr><td>Materials
• Empty film canister
• Glass of water
• Effervescent antacid tablets
• Safety glasses</td></tr>
</table>

Alka Rockets Family Discussion

How does this work?
Possible answer: Effervescent tablets are made up of citric acid and sodium bicarbonate that react to form carbon dioxide when dissolved in water. When Alka-Seltzer is added to the water in the film canister, carbon dioxide is released which builds pressure inside it. When the pressure builds high enough, it blows the canister apart from its lid. Thus, launching the rocket in the air.

How is this connected to the real word?
Possible answer: Actual rockets use the same concept. In an actual rocket engine, hot gas is produced by the burning of fuel. The gas is accelerated to the rear of the rocket. This produces a thrusting force, which makes the rocket "lift off.

Kindergarten through Second Grade Questions

Can you describe what you saw happen?
Possible answer: When you added the effervescent tablet and shock the container, it exploded.

What do you think made the rocket?
Possible answer: Shaking it and adding the effervescent tablet.

Third through Fifth Grade Questions

What made the canister fly off the lid?
Possible answer: The effervescent tablet and shaking it.

What was the solid, liquid and gas in the reaction?
Possible answer: solid- effervescent tablet, liquid- water, gas- explosion

What other reactions cause things to "fly off"?
Possible answer: pressure, bubbles, gas

Sixth Grade and Above Questions:

Ask the same questions but encourage them to be more detailed. Prompt them to explain why they are hypothesizing what they are.

Sticky Icky

Experiment: Sticky Icky	
Vocabulary **Polymer:** A natural or synthetic (man-made) substance made from joining together many small molecules or units. "Poly' means many and 'mer' means units. **Solution:** Two or more substances mixed evenly together	**Directions** Adult: In your plastic cup, mix one Tablespoon of plain warm tap water with one Tablespoon of white glue. Student: Stir well with a popsicle stick. Tell your partner which color to use for the next step. Adult: Add a few drops of food coloring to the glue and water mix. Student: Stir well with a popsicle stick, keep stirring during the next step. Adult: Slowly pour two teaspoons of the Borax solution into the glue and water mixture. Student: Keep stirring until there is no liquid left.
Materials • White school glue • Food coloring (various colors) • Borax (found in the laundry aisle) • Two pitchers: One labeled "Borax Solution," one labeled "Water Only" • Warm tap water • Plastic Tablespoons (some for water, some for glue) • Plastic Teaspoons (for Borax solution) • Six-ounce plastic cups (one for each student-adult pair) • Popsicle sticks (one for each student-adult pair) • Safety glasses	

Sticky Icky Family Discussion

How does this work?
Possible answer: The glue and water mixture contain chains of molecules, called "polymers," which move relatively freely as a liquid. When the Borax solution is added it crosslinks the polymer chains together, restricting their movement. It is this molecule in the Borax solution that causes the liquid to turn into slime.

How is this connected to the real world?
Possible answer: One characteristic of polymers is that—like Sticky Icky—they can easily take a variety of shapes. We see polymers all around us: in our plastic toothbrushes, cell phone cases, rubber-soled shoes, and even synthetic fabrics made into clothes and sheets! Knowing about polymers is useful in many STEM jobs from understanding DNA to designing smartphones.

Kindergarten through Second Grade Questions

What did you see happen to the glue and water as more things were added?
Possible answer: They starting forming a solid

Why do you think that happened?
Possible answer: The ingredients together, it changed into a different form. Some of the ingredients made it happen.

Did the sticky icky slime change as you stirred it?
Possible answer: Yes. It got tougher and turned into a solid.

Third through Fifth Grade Questions

Why do you think we needed to add the Borax solution?
Possible answer: It's the activator. It makes the slime.

Is your sticky icky slime a solid? a liquid? Or a little of both?
Possible answer: It's a little bit of both.

What did you notice happened to the substance as you stirred it?
Possible answer: It got tougher and turned more solid.

Sixth Grade and Above Questions

Ask the same questions but encourage them to be more detailed. Prompt them to explain why they are hypothesizing what they are.

Martian Jelly

Experiment: Martian Jelly	
Vocabulary **Basic:** A solution is basic if it has a low concentration of hydrogen ions, or a pH of greater than 7. Some examples of basic things are soap, bleach, ammonia and toothpaste. **Acidic:** The opposite of basic is acidic—acidic solutions have a high concentration of hydrogen ions and a pH of less than 7. Some examples of acidic things are lemon juice, coffee and soda.	**Directions** Student: Fill your plastic cup halfway full with warm water. Dissolve one spoonful of grape jelly in the cup and note the color. Adult: Add a pinch of baking soda and stir. Be careful! A fizzing reaction will occur, possibly causing it to overflow. Both: When the fizzing dies down, what do you notice? Adult: Slowly, add 2-3 spoonfuls of vinegar. Take care not to let any vinegar splash—it can sting your eyes! Student: Stir until the color of the grape jelly solution changes again.
Materials • 1 tablespoon grape jelly • 1/8 teaspoon baking soda (not baking powder) • 1 tablespoon vinegar • 1/2 cup of warm water • Popsicle stick to stir solution	

Martian Jelly Family Discussion

How does this work?
Possible answers: Chemical reactions occur when one chemical comes into contact with another. For example, when you added the baking soda (a base), a reaction occurred and it made the solution basic, changing the color of the grape jelly to a greenish-black. When you added vinegar (an acid), a reaction occurred, and the color of the grape jelly solution changed back to purple.

How is this connected to the real world?
Possible answers: Neutral pH (not basic or acidic) is best for most living beings. The more acidic or basic a liquid becomes, the more irritating it is to our skin, eyes and organs. For example, most household cleaners (bleach, oven cleaners and tub and tile cleaners) are basic. Many things we like to eat are acidic but can harm our stomach or damage our teeth in large quantities, like coffee, soda, or citrus juice. Knowing how to combine acids and bases is very helpful for baking and cooking and for scientists working with dangerous acids and bases.

Kindergarten through Second Grade Questions

What did you see?
Possible answers: The jelly changed color, and was darker. It also broke apart and came back together.

Can you describe what happened when the jelly changed color?

Possible answers: It turned dark.

Did you hear or smell any changes?
Possible answers: I smelled a change in the liquid.

Third through Fifth Grade Questions

Can you explain what happened when we added baking soda and when we added vinegar?
Possible answers: It changed the color and the consistency of the mixture in the glass.

Is the baking soda an acid or a base, why do you think that?
Possible answers: It's a base, because it does not change things a lot.

Is the vinegar an acid or a base, why do you think that?
Possible answers: It's an acid, because it adds bubbles.

Sixth Grade and Above Questions

Ask the same questions but encourage them to be more detailed. Prompt them to explain why they are hypothesizing what they are.

Bubbling Lava Lamp

<table>
<tr><th colspan="2">Experiment: Bubbling Lava Lamp</th></tr>
<tr><td>Vocabulary
Intermolecular polarity: Water molecules are attracted to other water molecules; oil molecules are attracted to other oil molecules. The structures of the two molecules do not allow them to bond together.

Density: Describes how much space an object or substance takes up (its volume) in relation to the amount of matter in that object or substance (its mass). If an object is heavy and compact, it has a high density. If an object is light and takes up a lot of space, it has a low density.</td><td rowspan="2">Directions
Adult: Help your student draw a line one fourth of the way from the bottom of the bottle.

Student: Pour water into the bottle up to the ¼ line.

Student: Pour vegetable oil until the bottle is nearly full. Leave at least 1 inch of space at the top.

Student: Add about 10 drops of food coloring to the bottle. Choose whatever color you like or try mixing two colors!

Adult or student: Break an effervescent antacid tablet into several pieces and drop one into the bottle. Close the cap tightly and flip the bottle over. When the bubbling stops, flip it over and add another piece.</td></tr>
<tr><td>Materials
• Water
• A clear plastic bottle with cap
• Vegetable oil
• Food coloring
• Effervescent antacid tablets</td></tr>
</table>

Bubbling Lava Lamp Family Discussion

How does this work?
Possible answers: Oil and water do not mix. The oil and water separate in the bottle, with oil on top because it has a lower density than water. The food coloring falls through the oil and mixes with the water at the bottom. The antacid “fizzy” tablet creates bubbles of carbon dioxide which is a gas and is less dense than both oil and water so it will move to the top and bring some of the colored water with it.

How is this connected to the real world?
Possible answers: When oil spills in the ocean, it floats on water, spreads out and forms a “slick.” This oil slick can coat and damage birds who dive for food, as well as destroy beaches and other homes for coastal animals. Understanding density and polarity is essential for people who help clean up oil spills and care for the animals.

Kindergarten through Second Grade Questions

Why do you think that happened?
Possible answers: The oil stayed on top of the water because it does not mix with water.

Which direction did the bubble go?

Possible answers: They float up.

Third through Fifth Grade Questions

What direction were the bubbles traveling?
Possible answers: The float up.

What happened when the 'fizzy' tablet was added?
Possible answers: It caused bubbles to come and float up.

What else did you see happening, can you explain what happened when the tablet was added?
Possible answers: It added bubbles to the water which reacted with the oil.

Sixth Grade and Above Questions

Ask the same questions but encourage them to be more detailed. Prompt them to explain why they are hypothesizing what they are.

Extensions

Additional experiments

To keep the STEM excitement alive by doing more activities as a family, go to:

- PTA.org/STEM/At-Home
- MakingScienceMakeSense.com/Science-Library/Experiments/

Email or post your photos and videos using these hashtags
#CrockettStemFestival
#CrockettFamilyScience
#CrockettFamilyArt
Crockettnjpta.org