

# DIY



BOYS & GIRLS CLUBS  
OF AMERICA

# STEM

# #3

## WEEKLY ACTIVITY GUIDES: FOOD CHEMISTRY

This week, we'll be learning how chemical reactions from combinations of different ingredients can be used to create products you can eat. Sometimes, an ingredient can change shape or color appearance, but otherwise remain the same. At other times, an object loses energy or changes its state of matter. It's always interesting to use food to learn about physical and chemical changes.

### ABOUT THE DIY STEM PROGRAM

DIY STEM is a program supported by Samsung as part of a shared commitment with Boys & Girls Clubs of America to inspire the next generation in science, technology, engineering, and math.

# SAMSUNG

Participate this summer by sharing photos of your experiments on social media **#STEM**



No matter your age,  
please enjoy conducting  
these experiments under  
the supervision of a  
responsible adult.

### MONDAY: SODA GEYSER

PAGE 1

#### MATERIALS:

- Eye protection
- Mentos mint-flavored candies (24)
- Wax paper
- Cutting board\*
- Knife
- Funnel
- Measuring cup
- Index cards (2)
- 2-liter bottle of Diet Coke
- Blue painter's tape
- Tape measure
- Ladder\*
- Outdoor space next to a wall where tape can be applied with permission
- Video camera\*
- Tripod\*

\*Optional



#### LEARNING OPPORTUNITY:

What makes the Coke/soda suddenly form a geyser?

Does the speed of the candy entering the bottle affect how large the geyser is?

## TUESDAY: ROCK CANDY

PAGE 2



### MATERIALS:

- Mason jar (2)
- Cotton string
- Water
- Measuring cup and spoons
- Small plate
- Granulated sugar
- Wax paper
- Screws for weights
- Wooden beads
- Popsicle stick
- Ruler
- Scotch tape
- Pot
- Stove
- Wooden mixing spoon
- Potholders
- Paper towels
- Markers



### LEARNING OPPORTUNITY:

Did the amount of sugar on your seeded string make a difference in the size of your rock candy?

What other steps could you have included to increase the growth of your rock candy?

## WEDNESDAY: MAKE YOUR SODA...POP!

PAGE 4

### MATERIALS:

- Baking soda (8 oz. box)
- Citric acid (50 g – you can find it at your local health foods store)
- Measuring spoons
- Plastic cups, clear
- Liquid measuring cup, 1 cup
- Wooden coffee stirrers
- Paper towels (1 roll)
- Sugar (50 g)



### LEARNING OPPORTUNITY:

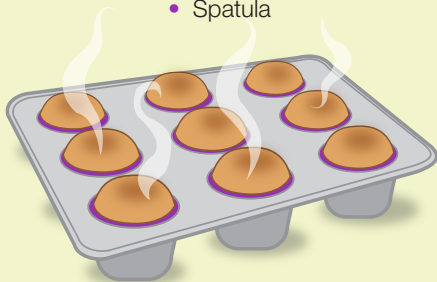
Which combination of baking soda, citric acid and sugar yields the most enjoyable soda?

## THURSDAY: BAKING EXPERIMENT

PAGE 4

### MATERIALS:

- 1 tsp baking powder
- 1 cup flour
- ½ cup sugar
- ¼ tsp salt
- 1 egg
- ¼ cup butter
- ¼ cup milk
- 1 tsp vanilla
- Muffin pan
- Mixing bowls
- Whisk
- Spatula



### LEARNING OPPORTUNITY:

How do your batches of cupcakes compare in size, appearance and taste?

Think about the role that the ingredient plays in the recipe.

## FRIDAY: EGG-SPERIMENTS

PAGE 5



### MATERIALS:

- Raw brown eggs (at least 6)
- Vinegar
- Corn syrup
- Water
- Food coloring
- Glasses or jars



### LEARNING OPPORTUNITY:

What do these different eggs teach you about osmosis?

## WEEKLY ACTIVITY GUIDES: FOOD CHEMISTRY

*This week, we'll be learning how chemical reactions from combinations of different ingredients can be used to create products you can eat. Sometimes, an ingredient can change shape or color appearance, but otherwise remain the same. At other times, an object loses energy or changes its state of matter. It's always interesting to use food to learn about physical and chemical changes.*

### Monday: Soda Geyser

#### Materials:

- Eye protection
- Mentos mint-flavored candies (24)
- Wax paper
- Cutting board\*
- Knife
- Funnel
- Measuring cup
- Index cards (2)
- 2-liter bottle of Diet Coke
- Blue painter's tape
- Tape measure
- Ladder\*
- Outdoor space next to a wall where tape can be applied with permission
- Video camera\*
- Tripod\*

\*Optional

#### Launch your geyser

1. Divide the Mentos into three equal groups on the wax paper (8 pieces each).
2. Carefully use the chosen tool (hammer, book) to crush the Mentos candies into many small pieces.

3. Take one of the index cards and roll it into a tube that is slightly larger than the diameter of a Mentos candy. The easiest way to do this is to wrap it around an unopened tube of Mentos.
4. Tape the tube together on the side.
5. Place the other index card beneath the tube of Mentos to keep the Mentos from dropping into the soda bottle until they are ready.
6. Prepare your test site to measure the height of the geysers.
7. Use a ladder if needed to mark off the taller measurements.
8. Add 4-8 whole Mentos (or the crushed equivalent) to your tube for each trial. Use funnels to help load the crushed Mentos candy pieces into the candy tube.
9. Go outside and set one bottle of Coke (or other soda) against an exterior wall.
10. Mark the top of the soda bottle with blue painter's tape. This will be your baseline measurement.
11. Mark the rest of the wall in 18-inch increments to measure your geysers as you conduct individual trials.
12. Optional: You can use a video camera on a cell phone or a tablet to capture each trial and verify the height of each geyser.
13. Place an unopened soda bottle outside of the area you have marked off, at least 6 feet away from the building. It's important to make sure that the bottle is also placed in a safe area where it is away from

buildings or a covered area that could be damaged after the bottle top launches. A clear open field with no coverings or roof would be ideal.

14. Remove the cap from the soda bottle and place the flat index card on top, covering up the mouth of the bottle.

15. Put on safety goggles.

16. Make sure to measure for each trial: the reaction time (from the last candy dropped in, to the time a geyser erupted), the height of each geyser, and the volume remaining in the bottle after the geyser erupted.

17. Place your full candy tube on top of the flat index card by lining the mouth of the bottle with the opening of your tube.

18. Remove the flat index card by pulling it to release the Mentos into the bottle. Lookout! The geyser will erupt quickly, so remove the empty candy tube and step away from the bottle as soon as the candy has dropped into the bottle.

19. When the bottle stops spouting, stop recording.

20. Remove the used soda bottle and set it aside. Do not pour out the remaining soda yet! You will measure the remaining volume of each soda bottle at the end of the activity.

21. Label the bottle with the trial number, and record whether it was used with whole or crushed Mentos.

22. Repeat the steps two more times, for a total of three trials using 4-8 whole or crushed Mentos each time.

## Tuesday: Rock Candy

### Materials:

- Mason jar (2)
- Cotton string
- Water
- Measuring cup and spoons
- Small plate
- Granulated sugar
- Wax paper
- Screws for weights
- Wooden beads
- Popsicle stick or pencil
- Ruler
- Scotch tape
- Pot
- Stove
- Wooden mixing spoon
- Potholders
- Paper towels
- Markers

### Grow Your Own Rock Candy

1. Cut two pieces of cotton string 1-2 inches longer than the height of the Mason jar.
2. Set one strand to the side until later in the activity – this is your control string.
3. Soak the second string in water for 7-10 minutes. This is the strand that will seed your rock candy.
4. Squeeze the water from the string so that it still remains moist, but it not dripping wet.
5. Roll the moistened string in 1 tablespoon of sugar on a plate.
6. Place your seeded (sugar-coated) string and your control string on a piece of wax paper. Make sure they are not touching.
7. Take each string and tie one end to a screw (or other small object) that serves as a weight. Some sugar may fall off of the string during this step (this is okay!).

8. Tie the other end of each piece of string to a pencil, popsicle stick or other object that serves as an anchor.
9. Use a marker, colored tape or another method to mark the pencil that holds the seeded string.
10. Lower the weighted end of the string into each of the jars. Rest the pencil across the top (mouth) of the jar. Each string should be about 1 centimeter from the bottom the jar. You may have to roll your string around the pencil to adjust the height.
11. Make sure an adult is there to help you with the next few steps! Fill each jar with boiling water using a funnel or other device to reduce the risk of splashing water and spills.
12. Keep the boiled water in each Mason jar until you are ready to replace this water with your sugar-water solution.
13. Now, let's make the sugar-water solution. Use a measuring cup to add 1 cup of water to a pot. Bring the water to a rolling boil on the stove.
14. Reduce heat to low.
15. Use a measuring cup to add 2 cups of sugar to the hot water, then mix with a wooden mixing spoon until all the sugar has dissolved.
16. Turn the heat back up and wait until the sugar-water solution returns to a rolling boil. Keep stirring to keep the solution consistent.
17. Remove the boiling sugar-water solution from the stove.
18. Continue to add 1 tablespoon of sugar at a time to the solution. Stir thoroughly after each spoonful, making sure the sugar is completely dissolved before adding more.
19. Continue adding sugar until no more dissolves in the solution. After all the sugar has dissolved, let the solution cool for five minutes.
20. Now, let's make candy! Pour the hot water out of the preheated glass jars.

21. After the sugar-water solution has cooled for five minutes, pour the solution into the two preheated glass jars, dividing the liquid equally between the two containers.
22. Flavor the sugar-water solution with individual packets of flavored candy or squeeze bottles used to flavor water.
23. Using potholders, move the jars of sugar-water solution to a place where they can be left undisturbed for one week. Place both jars in the same location.  
**Note:** temperature may disrupt the crystallization process. Avoid putting the jars in direct sunlight, or where they may be exposed to extreme hot or cold temperatures.
24. Lower the weighted strings into the jars of sugar-water solution, one string per jar.
25. Tape the pencils to the edges of the jars to prevent them from falling/rolling off.
26. Cover the jars with a paper towel to prevent dust and debris from falling in.
27. Watch your rock candy grow – check them once a day for seven days – then eat!

## Wednesday: Make Your Soda... Pop!

### Materials:

- Baking soda (8 oz. box)
- Citric acid (50 g – you can find it at your local health foods store)
- Measuring spoons
- Plastic cups, clear
- Liquid measuring cup, 1 cup
- Wooden coffee stirrers
- Paper towels (1 roll)
- Sugar (50 g)

### Make Your Soda...Pop!

1. Add 1/16 teaspoon of baking soda to the plastic cup.
2. Add 1/4 teaspoon of citric acid to the same plastic cup.
3. Gently swirl the cup to mix the baking soda and citric acid together.
4. Using the measuring cup, add 1/4 cup of cool, clear water to the plastic cup.
5. Use the wooden stirrer to quickly mix the solution together and then taste the beverage.
6. Rate how much it bubbles on a scale of 1 to 5 – where 1 is very bubbly and 5 is not bubbly at all.
7. Set the timer for one minute and leave the beverage alone. After one minute has gone by, take a sip of the beverage again.
8. Rate the bubbiness and grittiness using the same scale you used before. How is it after sitting undisturbed for one minute?
9. Repeat the procedure four more times using the following mixtures of baking soda and citric acid. Each time, pour any remaining liquid down the drain, rinse the plastic cups and wipe them with a paper towel.
  - a. 1/8 Tsp Baking Soda and 1/4 Tsp Citric Acid
  - b. 1/4 Tsp Baking Soda and 1/4 Tsp Citric Acid

- c. 1/2 Tsp Baking Soda and 1/4 Tsp Citric Acid
- d. 1 Tsp Baking Soda and 1/4 Tsp Citric Acid

10. Once you've decided on your favorite recipe, add sugar to sweeten the drink. Take a new, clean plastic cup and duplicate your favorite recipe from the first section.

11. Add 1/4 tsp of sugar to the beverage and quickly stir in the sugar with a clean, wooden stirrer.

12. Rate the sweetness of the beverage on a scale of 1 to 3, where 1 is not sweet at all and 3 is too sweet.

13. Repeat step 11 and 12, adding 1/4 tsp of sugar each time for a total of 3 times. Don't forget to rate the sweetness each time.

14. Repeat these steps again but add 1 tsp of sugar each time for a total of 3 times. Don't forget to rate the sweetness each time.

15. So, which one was your favorite?

## Thursday: Baking Experiment

### Materials:

- 1 tsp baking powder
- 1 cup flour
- 1/2 cup sugar
- 1/4 tsp salt
- 1 egg
- 1/4 cup butter
- 1/4 cup milk
- 1 tsp vanilla
- Muffin pan
- Mixing bowls
- Whisk
- Spatula

### Chemistry Cupcakes

1. Preheat oven to 350 degrees F.
2. Mix the first four ingredients in a bowl: baking powder, flour, sugar and salt. Note: You'll need to measure and mix this set of ingredients four times to complete all four experiments.

4. Mix the remaining ingredients in a second bowl: egg, butter, milk and vanilla.
5. Stir the ingredients from the second bowl into the first. Mix well.
6. Pour the mix into six cups of a muffin pan. Bake for 15-18 minutes.
7. Then, go on to bake three more batches with these recipe modifications:
  - a. For the second batch of cupcakes, use oil instead of butter.
  - b. For the third batch of cupcakes, leave the egg out.
  - c. For the fourth batch of cupcakes, leave the baking powder out.
8. After the cupcakes are cooled down, remove them from the muffin pan and line up one from each recipe group. Observe the differences in appearance – size, color and texture.
9. Cut them in half. Observe the differences in appearance on the inside of the cupcake.

Each cake is different because each ingredient has its own purpose. Both butter and oil help to add moisture to the cupcakes. But, the replacement of oil for butter will definitely have an impact on taste – who doesn't love the rich buttery flavor in food? Eggs help create a rich texture, add structure (light and fluffy versus dense) and helps the cupcakes "rise". Baking powder also helps the cupcakes rise and makes the cake light, fluffy and tender.

## Friday: Egg-speriments

### Materials:

- Raw, uncooked brown eggs (at least 6)
- Vinegar
- Corn syrup
- Water
- Food coloring
- Glasses or jars (6)

### Disappearing egg shell

1. Label 6 cups, one for water and five for vinegar. Pour in liquids until the cup is half-way full.
2. Carefully place an egg in each.
3. Leave the eggs overnight. The next day, observe the eggs. What do the eggs look like?
4. Carefully rinse the eggs under water and rub away any shell that is loose.
5. Rinse the cup and fill it with fresh vinegar.
6. Place the eggs back in the cup with fresh vinegar and leave overnight.
7. Again, rinse the eggs. The eggs should have no shell and will be quite rubbery. Touch it, squeeze it, bounce it.

### The shrinking egg

1. Pour corn syrup into three cups about half-way full.
2. Take three of the eggs with no shell and place each in a cup with corn syrup. Leave overnight.
3. Carefully rinse the eggs in corn syrup under water. The egg should be smaller and translucent.
4. Compare the shrinking egg to the one soaked in vinegar to the one in water. What are the differences?

### The colored egg

1. Remove the eggs in water. Add several drops of food coloring to the water and place two of the shrunken eggs in. Leave overnight.
2. Compare the colored egg to the other eggs. What are the differences? Will the colored egg bounce like the others?