GSK Science in the Summer™

Be a Chemist!

This summer, your child is invited to play the role of a scientist—a color chemist—to explore basic concepts of chemistry and solve a real-world problem.

Welcome to *GSK Science in the Summer*, brought to you at home this year in partnership between GSK and The Franklin Institute!

This free summer science program aims to inspire the next generation of scientists and engineers by inviting children to experience real science careers by practicing science skills and using real science tools—all while having fun!

This at-home science activity is supported by a series of online resources, including videos and a live, interactive virtual experience with a Franklin Institute science educator.

Here is the recommended sequence for your *GSK Science in the Summer Be a Chemist* experience:

1. Start by watching **short introductory videos** to help your child set up their lab and learn about their research project. Find these videos at scienceinthesummer.fi.edu by clicking on the "Medicinal Chemist" image.
2. Do your **at-home experiments**, using the guide in this booklet and the provided science materials. Remember to follow the safety guidelines during all activities.
3. Join a live **Color Chemist Team Meeting** to share the results of your research with a Franklin Institute educator and other *GSK Science in the Summer* participants. Information for how to register will be sent via email. For more information, visit scienceinthesummer.fi.edu/phila.

Are you ready to be a chemist? It's time to set up your lab and get started on your research!

COLOR CHEMIST

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Color Chemist

You are a **color chemist** working for a company that makes paints and inks for artists. The company has decided to make a set of watercolor paints that all come from things found in nature. Your job is to explore two natural materials and find out how many different colors of paint you can make from them.

MATERIALS

Color Chemist Materials:

- Lab notebook
- Pencil
- Well plate (plate with circular indentations)
- Pipettes
- Cochineal shells
- Butterfly pea flowers
- Vinegar
- Baking soda
- Small paper cups
- Toothpicks
- Watercolor paper strip
- Plastic spoons

Additional Materials:

- Table or other flat place to work
- (Optional) Tray or table covering to protect your workspace from spills
- Two metal spoons
- White piece of paper (can be used or scrap paper)
- Water

Lab Safety

1. All the chemicals you will use in this activity are safe to touch and can be washed down the sink drain or thrown in your regular trash when you are finished. ***Allergy alert: If you have an allergy to carmine red dye (also known as crimson lake or natural red #4), you should avoid touching the cochineal shells or any paints made from them.***
2. While the chemicals aren't harmful, you should still follow these lab safety rules:
   - **Don't touch your face or eyes** with hands that have touched the materials. Some of the materials could irritate your eyes.
   - **Wash your hands** with soap when you finish, or whenever you take a break to do something else.
   - **Don't taste the materials** or put them in your mouth for any reason.

Lab Prep

1. Gather your supplies. Make sure you have all your science tools and materials from the list above in one place.
2. Set up your lab space. Find a table or other flat surface that you can safely work on. If you have something like a baking sheet or school lunch tray with raised sides, that makes a good "lab station" to do your experiments on and contain any spills. If not, you may want to cover your lab surface with paper or plastic, or keep some towels handy to wipe up spills.

3. Label your tools. You will use pipettes to measure the baking soda and vinegar mixtures. To keep the chemicals from accidently getting mixed together, you should **use a separate pipette for each materia**l. Mark or label each one (like "B" for baking soda, and "V" for vinegar) so you don't mix them up.
4. Prepare your vinegar and baking soda mixtures. Put three spoonfuls of baking soda into a small paper cup. In a separate cup, add about six spoonfuls of vinegar. Mark the cups to help you remember what is in each one (like "B" for baking soda and "V" for vinegar). Add water to both cups until they are about half full. Stir or gently swirl each cup to mix the baking soda or vinegar into the water. Also prepare a separate small container of only water to use in the experiment.
5. Practice your technique. Try using the pipette a few times until you can easily measure the same amount each time. Squeeze the bulb of the pipette, put the tip of the pipette in the liquid, and let go of the bulb to let it fill up. Then, squeeze the bulb gently to let one drop at a time come out of the tip.
6. Look at the color chemist picture on page 15 in your lab notebook and read about what color chemists do. What do you think you will do in this activity that is like what a real color chemist does?

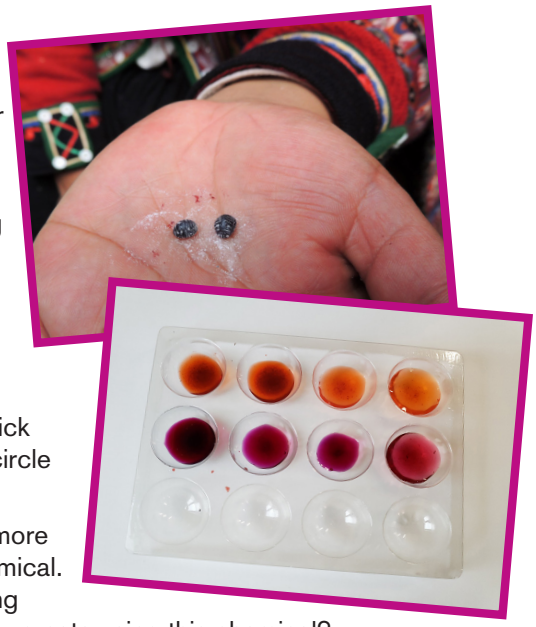
Part 1: Research

Observe your material and find out what color of paint it creates.

1. Choose a small sample of one of your natural materials—either the cochineal shells or butterfly pea flowers—to investigate first and look at it closely. What details do you notice? What color is it? What color paint do you think it might make? Think about how you could turn this material into a paint. What might you have to do or add to the material to make it work as a paint? The next steps provide one method for doing this, but you could also choose to test your own ideas.
2. You will need two spoons to crush the material—sturdy metal spoons work best, if you have them. If you are reusing the spoons you measured baking soda and vinegar with in the Lab Prep section, make sure you rinse them well with water to remove those chemicals before using them again.
3. Place your material in one of the spoons. (For the cochineal, you could add two or three shells together. For the butterfly pea, one flower should be enough.) Use a pipette to add a drop or two of water to the spoon.
4. Use the back of the second spoon to press down on the material and rub or grind it against the bottom of the first spoon to make a paste. Keep grinding until you have broken up the material as completely as you can.
5. Scrape the ground-up material out of the spoon and place it into a small cup. Add one pipette-full of water to the cup and gently swirl the cup or use a toothpick to stir the mixture.
6. Make some observations about the liquid in the cup. Draw or write your observations on page 10 or 11 of your lab notebook (depending on which material you chose).

Part 2: Testing

Add chemicals that change the acidity of your colored liquid and see how many different colors you can create from it.



1. Place your well plate on top of a white piece of paper. This will make it easier to see the color of the liquids you make. Add some of the colored liquid from your material to the first well (indentation) in your well plate.
2. Choose one of the chemical mixtures you prepared earlier (vinegar or baking soda) to test. Use a pipette to add a drop or two of the chemical to the well with the liquid.
3. Observe the results. Did the color change? Record your results in the first circle of the chart on page 10 or 11 of your lab notebook. Make sure to note which chemical you used, how many drops, and what change you noticed. You could also record the color of the liquid on the chart by dipping a toothpick into the well to collect a small drop of the liquid. Touch the toothpick to the circle on your chart to transfer the drop of color onto the circle.
4. Add some more of the colored liquid from your original material into several more wells in your well plate. In each well, add a different amount of the same chemical. Record your results in the appropriate circles on your chart. How does adding more drops change the color of the liquid? How many different colors did you create using this chemical?
5. Now test your material with the second chemical. (For example, if you started with baking soda, switch to vinegar.) Remember to record the numbers of drops and any color changes in your lab notebook! Note: If you run out of colored liquid in the cup, you can make more by adding a little more water and grinding more of your material.
6. Once you have created as many different colors from the material as you can with the vinegar and baking soda, make a color test strip to show and compare them. Add a large drop of each color from the well plate to a piece of watercolor paper. Label or number the drops so you can remember which color came from which chemical combination.

Part 3: Expand

1. Clean any tools you will reuse, like the well plate, spoons, or cups, by rinsing well with water.
2. Follow the steps of the research and testing process in Parts 1 and 2 of this guide using the second material. (For example, if you used the cochineal shells the first time, use the butterfly pea flower now.) Record all the results of your tests in your lab notebook, and make a color test strip to show the colors made from this material.
3. Compare the results from the two different materials. How does each one change when an acid (vinegar) or a base (baking soda) is added? How many different colors were you able to make altogether? Were there any colors that were similar between the two materials?

Part 4: Reflect

1. Think about the results of your experiments to create different colors of paint from the butterfly pea flower and cochineal shells. What suggestions could you give the paint company about how to make paints from these materials? How many different colors were you able to make for the paint set? Were there any colors you couldn't make that you think a paint set should have?
2. Think about how you were like a color chemist in this activity. What did you do that might be like what a color chemist does? What science skills did you use? Use page 6 in your lab notebook to draw or write about your ideas. Add some skill stickers from the sticker sheet to show some of the science skills you used in this activity.
3. Find out more about being a chemist! Try out the three other chemist activities featured in your lab notebook using the other *Be a Chemist* videos and activities found at scienceinthesummer.fi.edu. Or, check out some of the books and websites listed on the back of your lab notebook.

Want even more science? The Franklin Institute has created Franklin@Home (fi.edu/franklin-at-home), a series of science videos, do-at-home experiments, and live virtual science experiences that allow you and your family to continue discovering, exploring, and experimenting at home all summer long!