


**TINKER  
LAB** *At Home!*

# BAKING SODA-LIME EXPERIMENTS!

**Age:** 3+

**Materials:** Baking soda, Measuring spoon ( or any spoon), A Paintbrush, toothpick, or cotton swab, Water, A white piece of paper, A light bulb, Lime or lemon juice, A small dish or bowl, A stove ( ask an adult for help for this step)

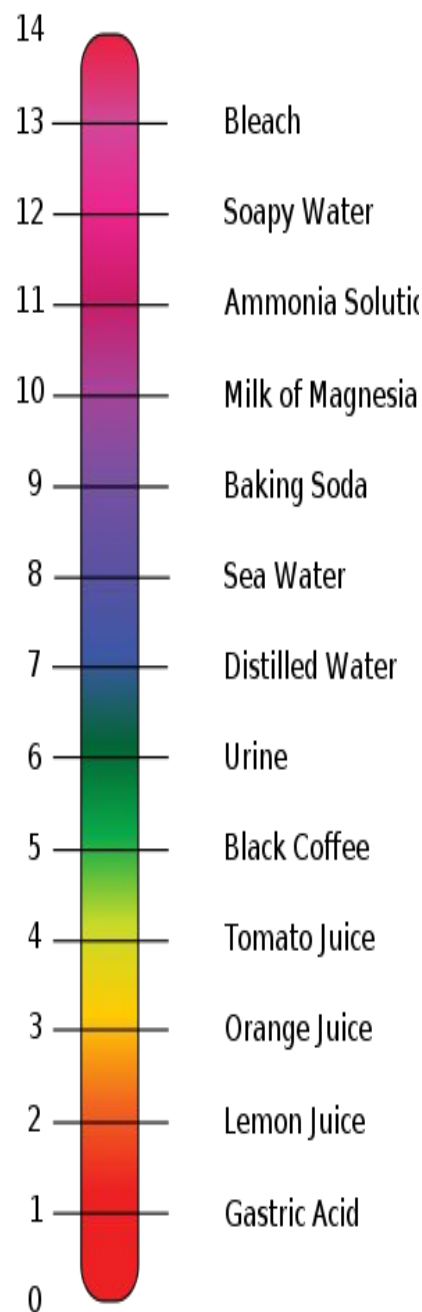
**Introduction:** Acids and bases are two special kinds of chemicals. Almost all liquids are either acids or bases to some degree. Whether a liquid is an acid or base depends on the type of ions in it. If it has a lot of hydrogen ions, then it is an acid. If it has a lot of hydroxide ions, then it is a base.

A pH scale measures how acidic or basic a liquid is. A pH is a number from 0 to 14. From 0 to 7 are acids, with 0 being the strongest. From 7 to 14 are bases with 14 being the strongest base. If a liquid has a pH of 7, it's neutral. This would be something like distilled water.

Baking soda, a substance found in most kitchens, has the chemical name sodium bicarbonate and has a pH of 9. Besides its role as an ingredient for cooking, it has many other uses; for example, it can clean surfaces, deodorize your refrigerator or remove odors from carpets.

Lime is an acidic fruit and has a pH of 2.40, very similar to the lemons, which have a pH of 2.30.

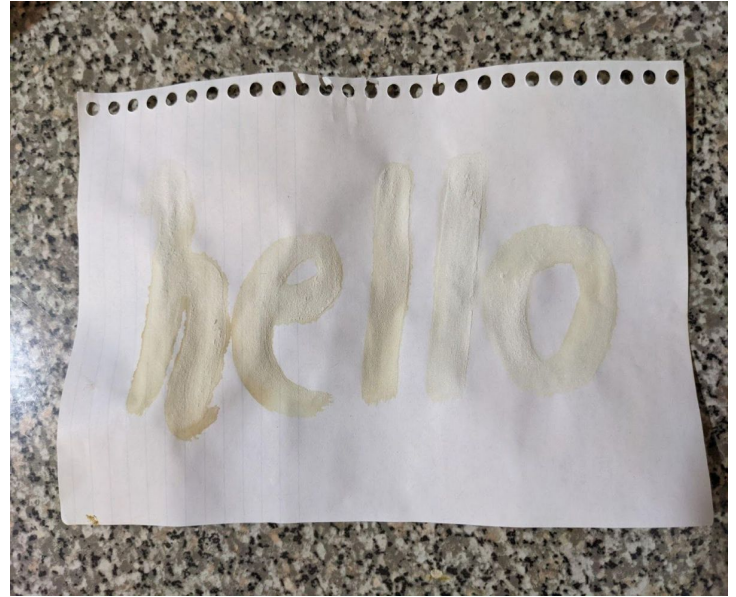
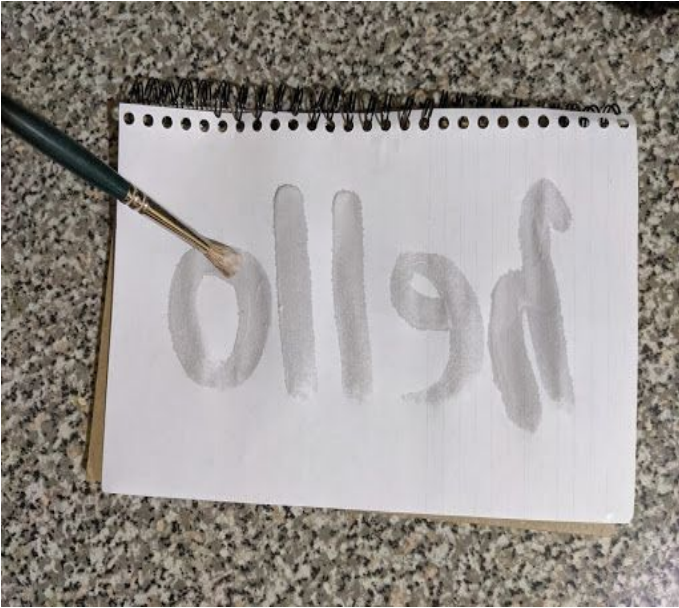
Today, we are making two different fun experiments with baking soda and lime juice, to observe what happens when they react to other surfaces like paper or with each other!



## Activity:

**1)** To start mix equal parts of baking soda and water in a small bowl or dish (for example, if you are using your measuring spoon, you can add 1 tsp of water and 1 tsp of baking soda into the bowl).

With the help of your paintbrush, toothpick, or cotton swab, write a message on the paper using the mixture.



**2)** Wait for the ink to dry and then, hold the paper up to a heat source, like a light bulb or close to the heat from the stove. You can also heat the paper by ironing it. Make sure to have a grownup to help you with this step. Your message should show up in brown!

You can give mysterious and invisible notes to your friends!

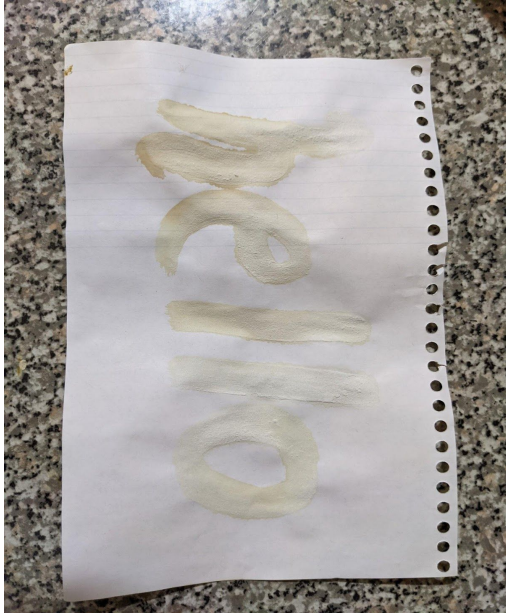
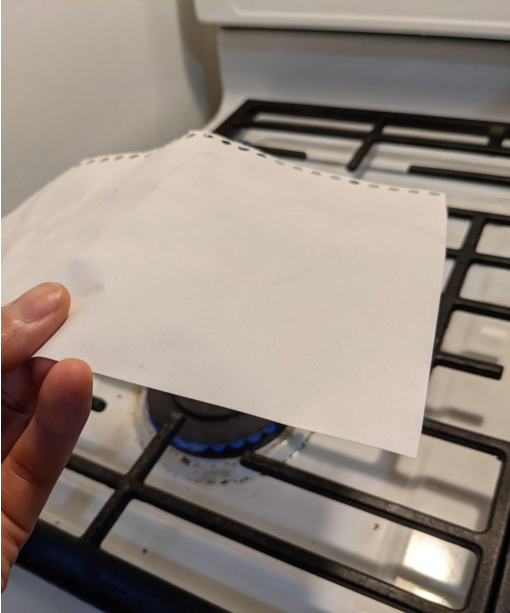
**Why does this happen?**

Writing a secret message in baking soda solution slightly disrupts the cellulose fibers in paper, damaging the surface. When the heat is applied, the shorter, exposed ends of the fibers darken and burn before the undamaged sections of the paper.



**3) Want to try another ink?**

Instead of using baking soda and water, use lime or lemon juice to write your secret messages.



**Why does this happen?**

The lime juice, which is acid, contains carbon, and when we add heat, some of the chemical bonds in the lime juice break down, releasing the carbon. When the carbon meets the air, it oxidizes and turns brown or black. You can try this experiment with other acids like vinegar and orange juice.



## LIME VOLCANO

**Age:** 3+

**Materials:** 1 lime ( or lemon), 1 teaspoon of baking soda, A paintbrush or a popsicle stick, A dish, Dish soap, Food colorant, A knife ( ask an adult to help with this step)

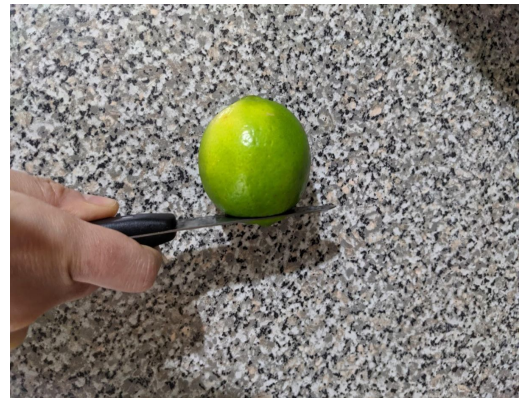
### Activity:

- 1) First, roll the lime or lemon on the counter with your hands to help lose the juice inside.

Ask an adult to cut off the bottom of the lime to make it flat with a knife. This is so the lime will stand up without flopping over or rolling away. Try not to cut into the flesh of the lime or it will start leaking.

- 2) Then, ask the adult to cut the top of the lime into the flesh to make a hole. This will be the top of the volcano.

Place your lime volcano onto the dish. Use a popsicle stick or the back of the paintbrush to squish and squash the lime pulp to release more juice. Scrape the sides along the inside of it, but try not to touch the bottom.



3) Squeeze a few drops of dish soap and some food coloring on to your volcano. This step is optional, but makes the experiment more fun!



4) Add a teaspoon of baking soda to the top of the lemon to activate your volcano. Watch what happens! Is it coming to life? Use your popsicle stick or the back of your brush to mix the juice and the baking soda together in case you need it.



### Why does this happen?

The lime juice (the acid) reacts with the baking soda forming carbon dioxide and sodium citrate, which causes the liquid to fizz and bubble.