



## Traveling Science Workshops

# Chemistry Lab: Chemical Reactions

Examples of chemical reactions are everywhere. Iron reacts with oxygen in the air to create rust. Oxygen and fuel combine to produce flames and heat. A chemical reaction happens when you combine two or more things and produce something different than what you began with. For instance, have you ever mixed baking soda and vinegar together? The foam you see bubbling up is a gas that was created in the reaction. It is neither baking soda nor vinegar.

Let's make some chemical reactions with things that you might find in your kitchen! *Note: If you do chemistry experiments at home, always work with an adult and never mix anything together that you do not know to be safe. Many chemical reactions can be very dangerous.*

### Exploring with Indicators

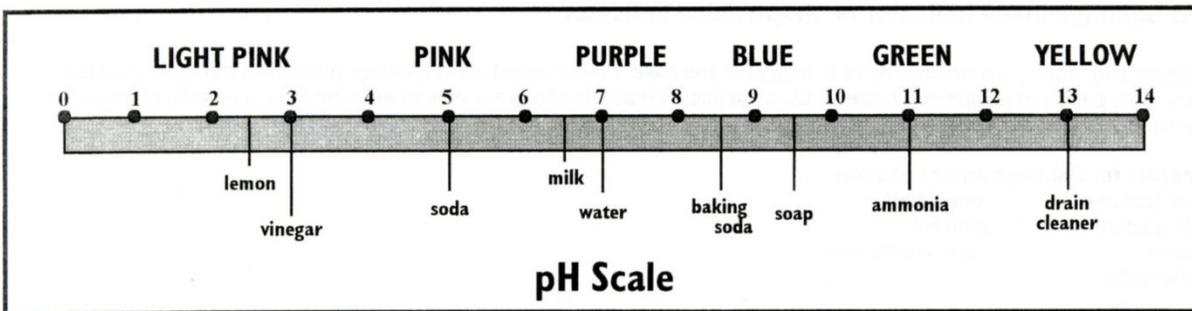
Substances called "indicators" change color to show the presence of other chemicals. We'll use an indicator that tell us if something is an *acid* or a *base*. In this experiment we will make indicator paper to help us discover common acids and bases in our home. But first, a little background information before we get started.

As you probably know, water is made of 2 hydrogens and 1 oxygen –  $H_2O$  or  $HOH$ . Hydrogen and oxygen are present in lots of other liquids as well. An *acid* is a chemical that has a lot of hydrogen or H present. Lemon juice and vinegar are two common acids that you can find at home. A *base* is the opposite of an acid. It has a lot of oxygen-hydrogen or OH in it. Bases are usually slippery feeling. Laundry detergent and baking soda are examples of everyday bases you will find around the house.

The strength of acids and bases are measured on the pH scale. You can think of it as a ruler for chemicals. The pH scale ranges from zero to fourteen. Water has a pH of 7, which is neutral on the pH scale. Substances with a pH less than 7 are acids, and those with a pH greater than 7 are bases. Most foods are acidic while most cleaners are basic.



A pH scale looks like this:



We can test whether common kitchen materials are acids or bases with the indicator paper we make.

## Making and Using Purple Grape Juice Indicator Paper

Red grape juice is an indicator of both acids and bases and will show whether an item is an acid or a base, as well as the relative strength of the acid or base.

### Step 1: Make Indicator Paper

#### Supplies

*Be sure to ask an adult for help as you gather your supplies*

- Purple grape juice
- water
- coffee filter
- mixing bowl

#### What To Do

Soak a coffee filter in grape juice for 10 minutes or more. Allow filter to dry for about an hour. (If you don't have time to wait, you can use the paper wet, but it will be a little bit messy.) Cut filter into strips.

*Be aware that purple grape juice can stain clothing. You may want to wear a cover-up or clothing that you don't mind getting dirty or stained.*

## Step 2: Experiment using Grape Juice Indicator Paper

### Supplies

*Be sure to ask an adult for help as you gather your supplies*

- clear plastic cups or glasses
- spoons or stir sticks
- a couple of Tablespoons of various chemicals such as: water, lemon juice, vinegar, lemon-lime soda (Sprite or 7-Up), equal parts baking soda and water mixed together to make a solution, dish or hand soap
- cotton swabs, toothpicks, or even your clean, dry fingers

*Warning: Mixing chemicals can be dangerous. Never mix chemicals without adult supervision.*

### What To Do

Place your indicator strips on a clean, well rinsed, and thoroughly dried plate. Dip a cotton swab, toothpick, or clean finger into each chemical listed above and touch it to a strip of indicator paper. Use a new swab, toothpick, or clean finger for each chemical so that you do not mix your chemicals accidentally.

*What do you notice?*

*Do you observe a color change on the indicator paper?*

*Can you use this color change to determine which chemicals are acidic and which are basic?*

### What Is Happening

Acids turn purple grape juice indicator paper pink. Bases turn purple grape juice indicator paper green or blue.

*Note: if your indicator paper is on a plate or other surface that has a residue of soap or other chemical on it, it may interfere with the results of your experiment. Always be sure to rinse your plate well and dry it before placing your indicator strip on it. Even paper plates might have chemicals used in them that will cause a different result to occur.*

## Experiments with Grape Juice

### Supplies

*Be sure to ask an adult for help as you gather your supplies*

- 6 clean, clear cups or glasses
- 6 Tbsp purple grape juice
- Water
- 1 Tbsp of each of various chemicals such as: water, lemon juice, vinegar, lemon-lime soda (Sprite or 7-Up), equal parts baking soda and water mixed together to make a solution, dish or hand soap (or as many as you have available)
- 6 clean spoons

### What To Do:

Fill each cup with 1 Tbsp purple grape juice and  $\frac{1}{2}$  cup water. Add 1 Tbsp of a single chemical to one of the cups and stir with a clean spoon. Continue to add a different chemical to each cup and stir with a clean spoon each time.

What do you notice?

Can you observe a color change in each cup?

Can you arrange the cups in a line resembling the pH scale? Start with the strongest acid on one end, neutral in the center, and the strongest base on the other end.

### More To Try

Make acid/base art using indicator papers, baking soda solution, and vinegar. cotton swabs, eyedroppers, or paintbrushes work well for applying the chemicals.

## Penny Polish

### Supplies

*Be sure to ask an adult for help as you gather your supplies*

- A tarnished penny
- A small glass jar or plastic container with a tight-fitting lid that does not leak
- table salt
- vinegar
- small bowl or cup
- paperclip

## What To Do

Add 1/8 of a cup of white vinegar to the jar or container. Add about 1 tsp of salt and stir until dissolved. Drop the penny into the jar or container and screw on the lid securely. Shake the jar with the penny vigorously for one minute. Pour the liquid from the container into a bowl and remove the penny. Dry the penny off and look at it.

Did shaking the penny in the salt and vinegar change the appearance of the penny? In what way?

## What Is Happening

Vinegar is an acid. When you drop the penny into the vinegar and salt solution and shake it, the tarnished copper on the penny reacts with acid and the salt scrubs it off. There is now copper tarnish dissolved in the vinegar.

## More To Try

Pour the leftover vinegar mixture back into the jar and drop a paperclip into it. Leave it set on a table or counter for at least an hour or two. Come back and look at it periodically.

What do you notice?

Has your paperclip changed in appearance?

## What Is Happening

Over time the metal of the paperclip reacts with the copper tarnish, and the paperclip becomes plated in copper (see photo). If you do not notice a change, let the paperclip sit for several more hours or even overnight.



## Invisible Ink

### Supplies

*Be sure to ask an adult for help as you gather your supplies*

- Baking Soda
- Water
- Plastic cup or a glass
- Cotton swab, paintbrush, or your finger to act as a “pen”

- Piece of white paper
- Oven
- An adult to supervise

## What To Do

Mix equal parts water and baking soda and stir to dissolve. Dip your “pen” or paintbrush in the solution and use it to write a message onto white paper. Allow the ink to dry.

To discover the message, heat your oven to 400 degrees Fahrenheit. Place the paper on a baking sheet and bake for 5 -10 minutes. Remove the baking sheet from the oven and allow it to cool.

Then, examine your paper.

Can you read the message?

## What Is Happening

When you heat the paper, the baking soda and water solution burns faster than the rest of the paper, and your message becomes visible.

## More To Try

**Invisible Ink Alternative.** Instead of baking your paper, you can paint over your secret message using purple grape juice. Just as in our first activity, the reaction between the acid in the juice and the base in the “ink” will cause it to change color.

## Share Your Discoveries with Us!

We want to know about your Chemistry explorations. Share your experience with us in any of the following ways:

- Draw a picture
- Take photos of your results
- Write down what happened, what surprised you, what didn't surprise you, or anything else that was fun or interesting about your experiences.

Then email us at [myhomediscoveries@discoveryacton.org](mailto:myhomediscoveries@discoveryacton.org). We can't wait to hear from you!

## Resources

What is a Chemical Reaction? Fizzy Soda Experiment

<https://www.youtube.com/watch?v=h5pPwXCtm60>

Grape Juice Indicator Experiments Make for a Great Magic Show

<https://www.youtube.com/watch?v=ujkuW-0cpNw>

More Penny Polish Activities

<https://www.finishing.com/faqs/pennies.shtml>

More Chemistry Experiments for Kids

<https://www.science-sparks.com/brilliant-chemistry-experiments/>