

# Chemistry's Rainbow

NEUTRALIZE AN ACID AND A BASE



## STUDENT LAB GUIDE

Name \_\_\_\_\_



# Chemistry's Rainbow

## NEUTRALIZE AN ACID AND A BASE

Color changes can give you important information. You might wait for a banana peel to change from green to yellow before eating it because yellow bananas are ripe and sweeter than green ones. You might select a golden brown piece of toast over a black one, because you know the brown toast is going to taste good, not burnt. Perhaps you have seen toys that change color in hot or cold water. You use color changes in your daily life.

Chemists use color changes in their work. The activities you are about to do with your visiting scientist use the color changes of a chemical called an indicator to find out about different substances. After working with your visiting scientist, you will be able to interpret these color changes the way chemists do.



Today, you will do chemistry!

*What have you learned about universal indicator?*

*What are some common examples of acids?*

*What are some common examples of bases?*

*The pot on the cover of your Student Lab Guide is filled with lemons and bars of soap. Why do you think lemons and soap are in the picture?*

# Get ready for the activity



## LABEL YOUR EQUIPMENT

1. Place a citric acid solution label on one cup and a sodium carbonate solution label on another cup.
2. Place a citric acid solution label on one dropper and a sodium carbonate solution label on the other dropper.



## MAKE ACID AND BASE SOLUTIONS

3. Use your beaker to add 10 milliliters (mL) of water to the cups labeled citric acid solution and sodium carbonate solution.
4. Add 2 scoops of citric acid to the citric acid cup. Gently swirl until the citric acid dissolves. This is your citric acid solution.



5. Add 2 scoops of sodium carbonate to the sodium carbonate cup. Gently swirl until the sodium carbonate dissolves. This is your sodium carbonate solution.



## MAKE UNIVERSAL INDICATOR SOLUTIONS

- Use your beaker to add 20 mL of water to each of three clear plastic cups.
- Line the cups up on a piece of white paper.
- Add 10 drops of universal indicator to each cup.



*Do you think the color of the indicator solution will change if you add drops of citric acid or sodium carbonate to it?*

*Why do you think the color will change?*

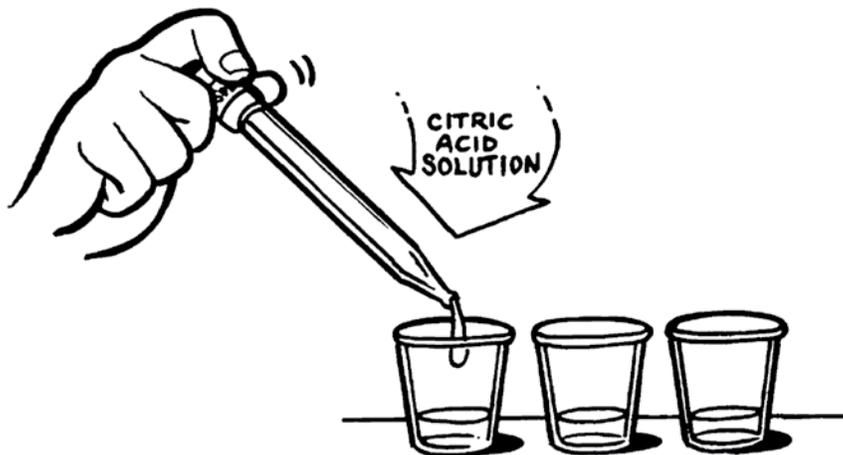
*You will not add anything to one cup. This cup is called a control. Why is it important to have a control?*

# Test your solutions



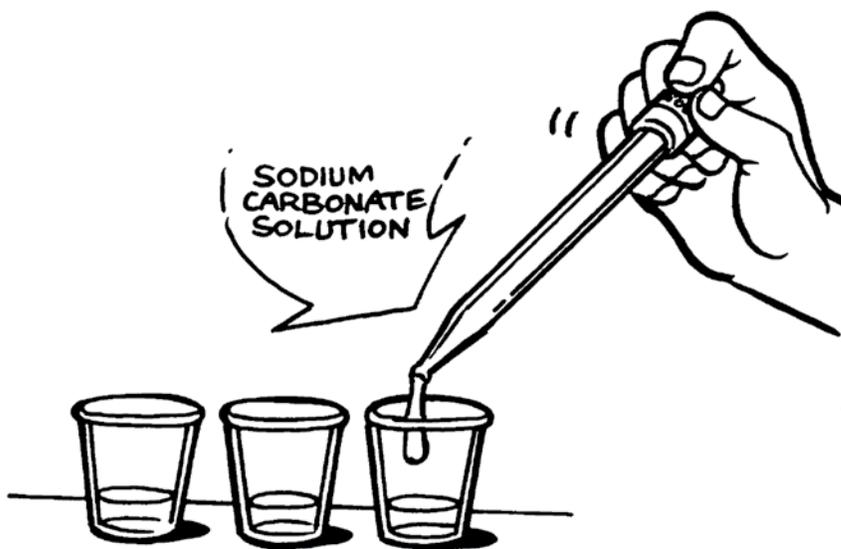
## CITRIC ACID

1. Add 1 drop of citric acid to the cup on the left. Gently swirl the liquid in the cup and observe.
2. Compare the color of the liquid to the control and to the Universal Indicator pH Color Chart.
3. Continue to add a single drop, swirl, and compare until you have added a total of 5 drops.



## SODIUM CARBONATE

4. Add 1 drop of sodium carbonate solution to the cup on the right. Gently swirl the liquid in the cup and observe.
5. Compare the color of the liquid to the control and to the Universal Indicator pH Color Chart.
6. Continue to add a single drop, swirl, and compare until you have added a total of 5 drops.



What do you think you could do to return the red and purple solutions back to their original green color? HINT: Acids and bases are chemical opposites.

Should we add several drops at once or one drop at a time?

If you can return the red indicator back to green, will the final solution be an acid, a base, or neutral?

If you can return the purple indicator back to green, will the final solution be an acid, a base, or neutral?

# Neutralize your solutions



## NEUTRALIZE THE CITRIC ACID SOLUTION

1. Add one drop of sodium carbonate solution to the indicator in the red cup and swirl.

2. Add another drop of sodium carbonate and swirl again.

3. Continue to add single drops of sodium carbonate and swirl until the color is close to the color of the control.



*How many drops of sodium carbonate did you add?*

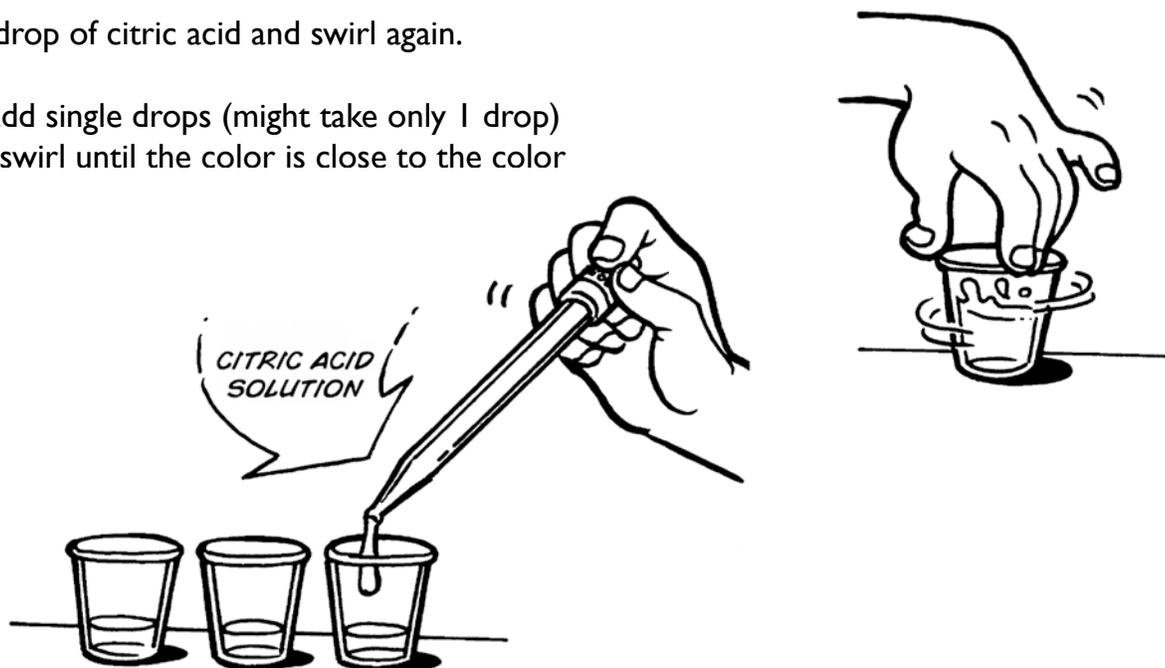
*How did you know when your solution became neutral (or close to it)?*

*With each drop of sodium carbonate, did the solution become more acidic or less acidic?*

*What will you do to neutralize the purple solution?*

## NEUTRALIZE THE SODIUM CARBONATE SOLUTION

1. Add one drop of citric acid to the indicator in the purple cup and swirl.
2. Add another drop of citric acid and swirl again.
3. Continue to add single drops (might take only 1 drop) of citric acid and swirl until the color is close to the color of the control.



*How many drops of citric acid did you add?*

*How did you know when your solution became neutral (or close to it)?*

*With each drop of citric acid, did the solution become more basic or less basic?*

# The grand finale

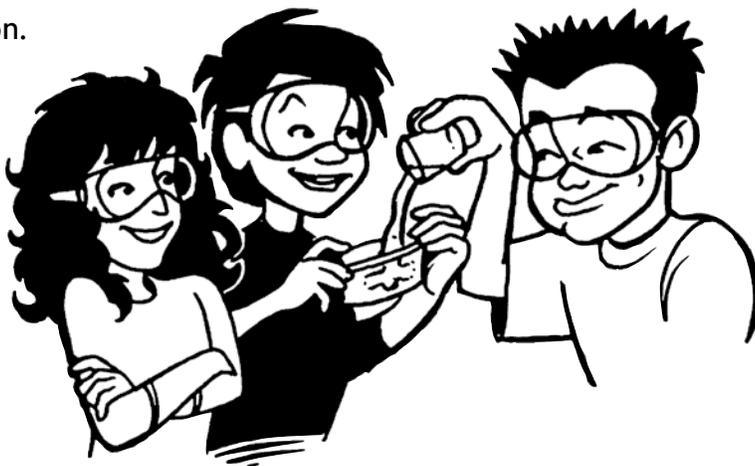


In this activity, you will apply what you have learned about universal indicator's amazing color changes to a chemical reaction. You will find out what happens when you place an Alka-Seltzer tablet in universal indicator solution!

First, you should know a little bit about Alka-Seltzer. These tablets contain powdered acids and a base. The acids are citric acid, which tastes a little sour, and salicylic acid, which is aspirin. The base is baking soda, which is also known by its chemical name sodium bicarbonate. Sodium bicarbonate and the sodium carbonate you worked with today have similar names, and both are bases, but they are different chemicals with different uses. Now that you have the background, let's get started!

## ALKA-SELTZER IN UNIVERSAL INDICATOR SOLUTION

1. Add 20 mL of water to a snack-sized zip-closing plastic bag.
2. Add 10 drops of universal indicator solution.
3. Seal the bag.
4. Either your teacher or the visiting scientist will place an Alka-Seltzer tablet in the bag and quickly reseal it.
5. Take turns shaking the sealed bag and observe all the changes.



# Clean-up

Wear your goggles as you pour the liquids from your cups into a waste container. Watch the amazing color changes!



Place the following back in the bag:

- Citric acid powder
- Sodium carbonate powder
- 2 scoops
- Beaker
- Universal Indicator pH Color Chart

The cups and droppers may be placed in the trash or washed and reused. The cups should never be reused with food or drinks!

Follow your teacher's instructions to wash your desk and hands.

# Congratulations!

YOU DID CHEMISTRY!



Visit [www.acs.org/kids](http://www.acs.org/kids) for more science activities you can do at home.



# What did you learn?

*What does an indicator do?*

*If you add a substance to universal indicator and it turns red, what can you say about the substance?*

*If you add a substance to universal indicator and it turns purple, what can you say about the substance?*

*How can you neutralize an acid?*

*How can you neutralize a base?*

