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ABSTRACT

This book presents science activities investigating the chemical changes and reactions with powders that are used in baking. Activities include: (1) Mystery Powders; (2) Find the Fizz: Discover the Secret of Baking Powder; and (3) A Feast for Yeast and Cheese: Behold the Power of Chemistry. (YDS)

Get Cooking! WITH CHEMISTRY

Mystery Powders

Chemistry is a science that deals with all the different kinds of matter in the universe. People who study chemistry try to figure out what the different solids, liquids, and gases that make up matter are made of. They also try to find out how these different kinds of matter can be put together, taken apart, and used to make other substances that help make our lives better.

For human beings and all other living things, a very important type of matter or substance is food. All living things need food to survive. Chemistry is very important when it comes to food.

Since everything you see, touch, taste, and smell is made of chemicals, food is made of chemicals, too. The mixing and cooking of ingredients to make food usually involve a chemical change or **chemical reaction.**

In the activities in this booklet, you will be the chemist! You will do chemical tests to identify some different powders used in baking. You will also mix ingredients and observe some of the chemical reactions that take place when certain foods are made. Be sure to have an adult helper present when you carry out these activities.

In this first activity, your job is to carry out chemical tests on certain powders used in cooking. After doing the tests, you will try to figure out the identity of a mystery powder!

YOU WILL NEED

2 sheets of paper	Water
Pencil	Tincture of iodine
Wax paper	Vinegar
Masking tape	Red cabbage
Baking powder	9 small plastic cups
Baking soda	4 droppers
Cornstarch	Zip-closing plastic bag
Cream of tartar	Measuring spoons

Preparation

1. The adult helper should carry out this step. Prepare the iodine solution by adding about 10 drops of tincture of iodine to 1 tablespoon of water.

   CAUTION: Be very careful when using tincture of iodine. Read and follow all directions on the label.

2. With the assistance of an adult, prepare the red cabbage solution by tearing up 1 or 2 leaves of red cabbage. Place the pieces in a zip-closing plastic bag. Add about $\frac{3}{4}$ cup warm tap water. Seal the bag and squish the cabbage for about 3–5 minutes until the water turns a medium to dark blue.

3. Use masking tape and a pen to label 5 plastic cups, each with one of the following names: "baking powder", "baking soda", "cornstarch", "cream of tartar", and "mystery powder". Place 1 teaspoon of each of the first 4 powders into their labeled cups.

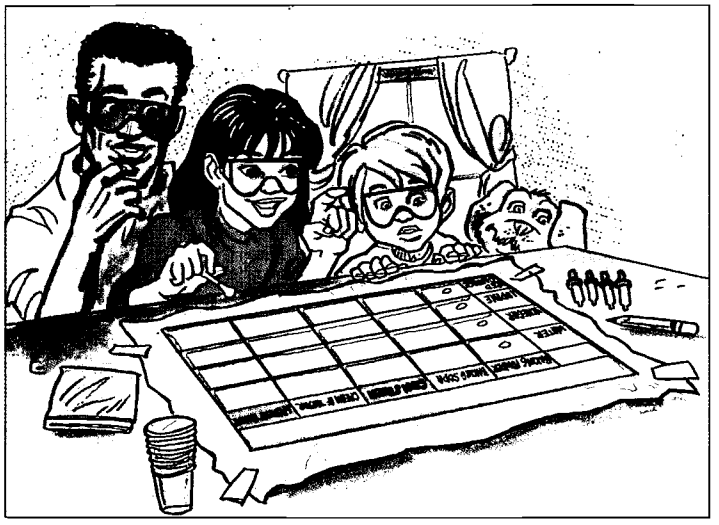
   NOTE TO ADULT HELPER: Secretly select the mystery powder from one of the powders being used in the investigation and place 1 teaspoon of it in the cup labeled "mystery powder".

4. Now label 4 different cups, each with one of these names: "water", "iodine solution", "vinegar", and "red cabbage solution". Place about 2 teaspoons of each solution into its labeled cup.

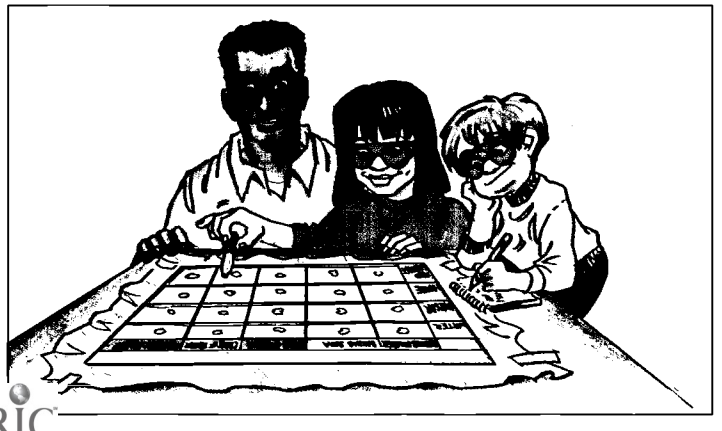
Student Activity

1. Make 2 charts like the one shown here. Label one "Testing Chart" and the other one "Observation Chart". Cover your Testing Chart with a sheet of wax paper. Use masking tape to tape the wax paper down as shown.

2. On the Testing Chart, place about a $\frac{1}{8}$ teaspoon sample of baking powder in each of the 4 boxes under the "baking powder" column. Repeat this step for each of the other 3 powders so that you have 4 samples of each powder under each powder's name.



3. Use a dropper to place 4 or 5 drops of water on the baking powder sample in the row marked "water". Record your observations in the Observation Chart. Now add 4 or 5 drops of water to each of the other 3 powders along the row marked "water". Watch closely each time and write down your observations in the Observation Chart.



Testing Chart and Observation Chart

	Baking powder	Baking soda	Cornstarch	Cream of tartar	Mystery powder
Water					
Vinegar					
Iodine					
Red Cabbage					

4. Use a clean dropper to put 4 or 5 drops of vinegar on each powder along the row labeled "vinegar". Watch closely and write down your observations in the Observation Chart.

5. Repeat Step 4 using the iodine solution on each powder in the row labeled "iodine" and then use the red cabbage solution on each powder in the row labeled "red cabbage". Watch closely and write down your observations.

6. Now place a $\frac{1}{8}$ teaspoon sample of the mystery powder in each square under the "mystery powder" column. Use 4 or 5 drops of each liquid to test the mystery powder the way you tested the other powders. Based on your observations, what do you think the mystery powder is? Give some reasons that helped you make your decision.

7. Rinse the materials from the wax paper and the cups down the drain. Put the cups and wax paper in the trash. Wash your hands when you are finished.

Find the Fizz:

Discover the Secret of Baking Powder

When you did the mystery powder activity, you probably noticed that baking powder mixed with water made bubbles. Mixing baking powder and water causes a chemical reaction that produces a gas. Gas bubbles are an important part of making cakes, breads, muffins, and cookies. These baked foods are light and fluffy because of the gas bubbles produced when the ingredients are mixed and baked. Let's investigate ingredients that combine to make gas bubbles!

Hint #1: Baking powder is made of **baking soda** plus another ingredient.

Hint #2: The other secret ingredient is either flour, cornstarch, or cream of tartar.

YOU WILL NEED

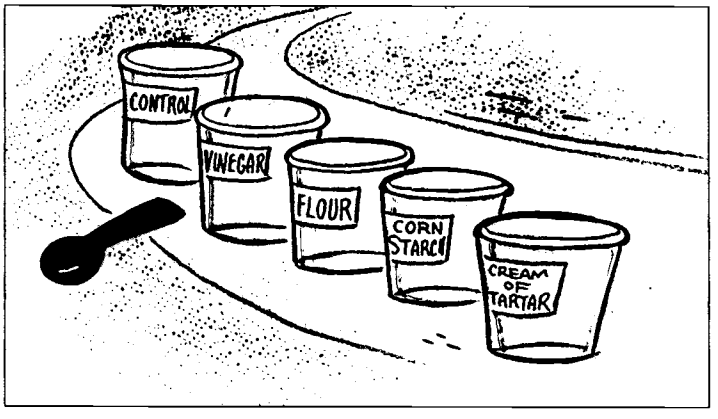
- Vinegar
- Baking soda
- Baking powder
- Cream of tartar
- Flour
- Cornstarch
- Red cabbage
- 10 small plastic cups
- 5 pipettes
- Masking tape
- 3 Popsicle sticks
- Pen
- Measuring spoons

Prepare test solutions

1. Take 3 small cups and label each with one of the following names: "flour", "cornstarch", and "cream of tartar". Use masking tape and a pen to make the labels.

2. Add $\frac{1}{2}$ teaspoon each of flour, cornstarch, and cream of tartar to its labeled cup.

3. Add 2 teaspoons of water to each cup and stir each with a clean Popsicle stick.



Prepare indicator solution

4. Take 5 clean small cups. Using masking tape and a pen, label each cup with one of the following names: "control", "vinegar", "flour", "cornstarch", and "cream of tartar".

5. With the assistance of an adult, prepare the red cabbage indicator solution by tearing up 1 or 2 leaves of red cabbage. Place the pieces in a zip-closing plastic bag. Add about $\frac{3}{4}$ cup of warm water. Seal the bag and squish the cabbage for about 3–5 minutes until the water turns a medium to dark blue.

6. Place about 1 teaspoon of red cabbage indicator in each of the 5 cups.

Comparing white powders to vinegar

In the mystery powders activity, baking powder fizzed when you added water, and baking soda fizzed when you added vinegar. Remember, baking powder is made of baking soda plus another ingredient. When water is added, this other ingredient reacts with baking soda just like vinegar reacts with baking soda. Find out one thing the mystery ingredient has in common with vinegar.

7. Using a clean pipette, add 3 drops of vinegar to the indicator in the cup labeled "vinegar" and swirl carefully. What do you observe?

8. Using a clean pipette, add 3 or 4 drops of the flour solution to the indicator in the cup labeled "flour". Swirl carefully and observe.

9. Using a clean pipette, add 3 or 4 drops of the cornstarch solution to the indicator in the cup labeled "cornstarch". Swirl carefully and observe.

10. Using a clean pipette, add 3 or 4 drops of the cream of tartar solution to the indicator in the cup labeled "cream of tartar". Swirl carefully and observe.

11. Which of the three solutions, flour, cornstarch, or cream of tartar, gave a result similar to the result you saw with vinegar? What does this tell you about that substance?

Comparing baking soda and vinegar to the secret ingredients

12. Retest baking soda with vinegar. Place about 2 teaspoons of vinegar in a small plastic cup. Now add about $\frac{1}{2}$ teaspoon of baking soda and swirl. What do you observe?

13. If baking soda and vinegar cause fizzing, which powder might also fizz when mixed with baking soda and water? Let's try it! Add $\frac{1}{2}$ teaspoon of baking soda to the cream of tartar solution from step #3. What do you observe? Baking powder is probably made of baking soda and _____.

14. Dispose of all liquids down the drain. Place the cups in the trash. Wash your hands when you are finished.

A Feast for Yeast

Another popular gas bubble-maker is yeast. Unlike baking powder and baking soda, yeast is a living organism. Since yeast is alive, it needs water and food to grow. As yeast cells use their food, they give off a gas that makes bubbles. Find out what yeast cells like to eat by feeding them the ingredients in plain bread—water, flour, sugar, and salt.

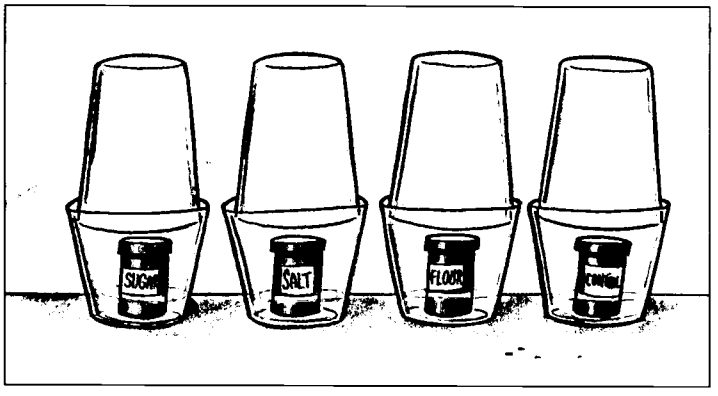
1. Use masking tape and a pen to label each of the 4 film canisters with one of the following names: "control", "sugar", "flour", and "salt". Add $\frac{1}{2}$ teaspoon each of sugar, flour, and salt to the properly labeled canisters.

2. Add $\frac{1}{2}$ teaspoon of yeast to each canister, including the control. Put the lids securely on the canisters and shake.

3. Add 2 tablespoons of hot tap water to each of the 4 short wide clear plastic cups.

4. Remove the lids from the film canisters and add 1 tablespoon of hot tap water to each. Place the lids on the canisters securely and shake them a couple of times to mix.

5. Stand each canister up in the water in a short wide cup. Be certain the canister remains standing. Place a tall clear plastic cup upside down over each of the short cups so the tall cup fits snugly inside the shorter cup. Watch and listen for the first cap to pop. You may have to wait 3–5 minutes. Which cap popped first? What ingredient does yeast most like to eat? Why do you think that?



6. Take the tops off each of the film canisters. Compare the control canister to the flour and salt canisters. What is a yeast cell's second favorite food? How do you know?

7. Dispose of the reaction mixtures down the drain, and put the rinsed film canisters and cups in the trash. Wash your hands when you are finished.

YOU WILL NEED

- 1 envelope of Rapid Rise yeast (7 grams)
- White all-purpose flour
- Sugar
- Salt
- Warm tap water (somewhere between 105 and 130 °F)
- 4 film canisters with lids
- 4 short wide 9-ounce clear plastic cups
- 4 tall 10-ounce clear plastic cups
- Masking tape
- Pen
- Measuring spoons

Cheese:
Behold the Power of Chemistry!

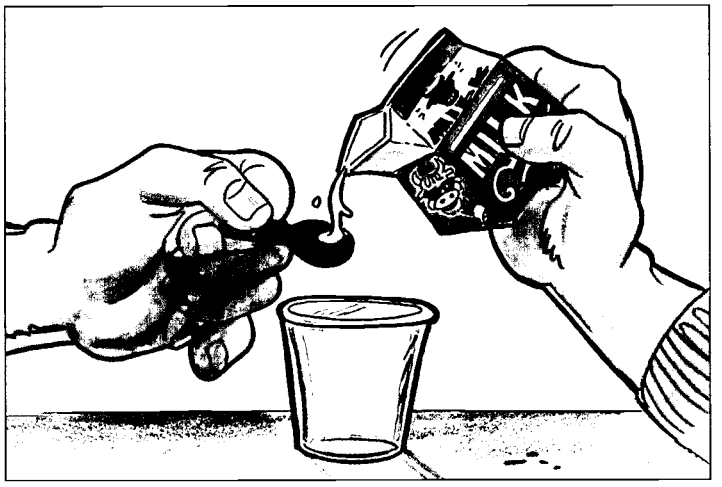
You couldn't have cheese without chemistry. Try this experiment to get an idea of how cheese is made.

After you prepare the cheese, **do not eat** your product. Before cheese is sent to the store for us to buy and eat, it undergoes a series of treatments that make it safe to eat.

1. Add 1 teaspoon of cream of tartar and 1 tablespoon of vinegar to one of the small cups. Stir until the powder is dissolved.

2. In another cup, add 2 tablespoons of fresh milk. You may use 2 tablespoons of water and 1 teaspoon of dry milk instead.

3. Pour the cream of tartar and vinegar solution



into the cup of milk and stir. Describe how your milk changed.

4. Place the coffee filter in an empty small cup. Pour the solids (curds) and liquid (whey) into the filter. Wait for as much liquid as possible to drain into the cup.

5. Gently squeeze the remaining liquid out of the filter.

6. Open the filter and put the curds into one of the cups. Reach into the cup and feel the curds. What do the curds feel like? You just made cheese! Be sure to wash your hands when you finish.

7. Dispose of all liquids down the drain. Put the cheese and cups in the trash. Wash your hands when you are finished.

REMEMBER: Do not taste the cheese you just made.

Cheese is made by adding either an acid, microorganisms, or enzymes to milk. Behold the power of chemistry!

YOU WILL NEED

- Vinegar
- Cream of tartar
- Water
- Milk (You can use dry milk and water instead of milk.)
- 3 small cups
- Small coffee filter (No. 1 Melitta®)
- Popsicle stick
- Measuring spoons

Join Us! For National Chemistry Week!

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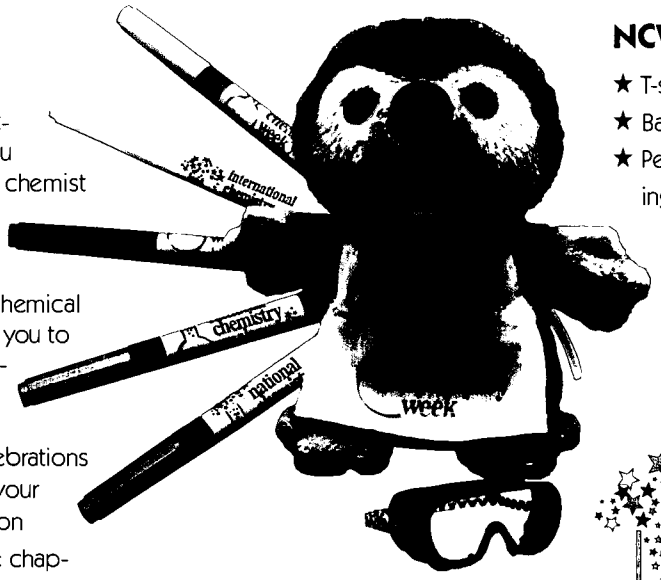
Step into the spotlight and show you are proud to be a chemist during National Chemistry Week 2000, a program of the American Chemical Society! We invite you to initiate and participate in:



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national chemistry week

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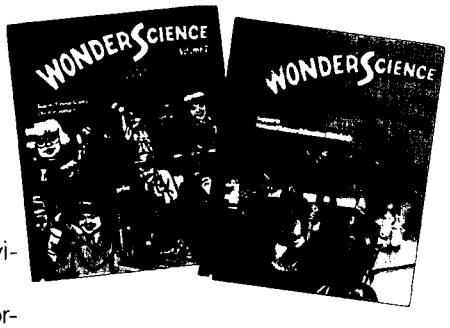

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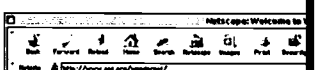

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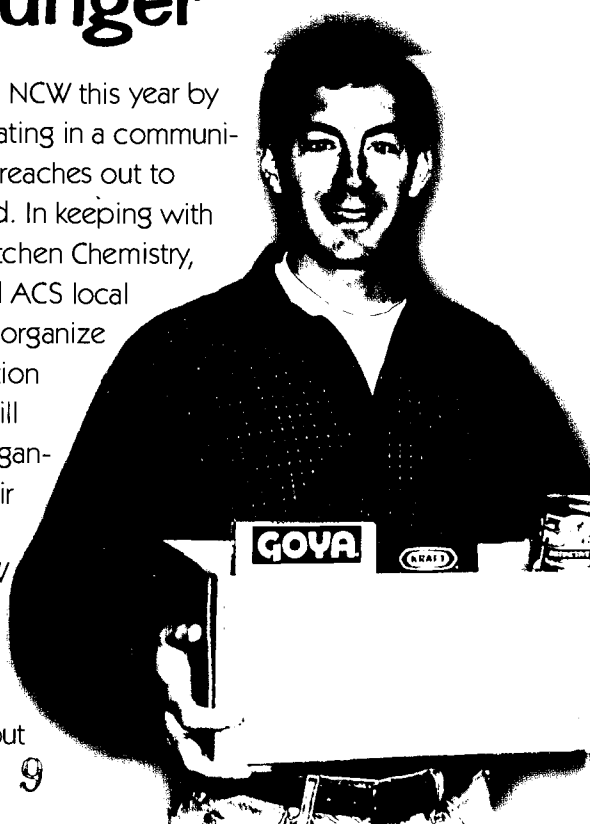
National Chemistry Week 2000
Kitchen Chemistry Unifying Event

Chemists Reacting to Hunger

Celebrate NCW this year by participating in a community event that reaches out to those in need. In keeping with the theme Kitchen Chemistry, chemists and ACS local sections will organize food collection drives that will benefit an organization in their community. Visit the NCW Web site, **www.acs.org/ncw**, to tell us about your event.



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