

**Thank you for inviting COSI on Wheels into your school! To enhance your students' experience, we encourage you to continue to explore the basics of chemistry in your classroom or home.**

### **Extension Activities:**

- Naked Egg
- More Secret Messages
- Heat It UP
- Cabbage Chemistry
- Kitchen Cupboard Slime
- Booklist

# NAKED EGG

**ACADEMIC STANDARDS:** Physical Sciences 1.3, 4.2

**OBJECTIVE:** To remove the shell from a raw egg without breaking it; to observe chemical changes.

## **MATERIALS:**

- 1 pint glass jar with lid
- 1 raw egg
- 1 pint of clear vinegar

## **PROCEDURE:**

1. Place the whole raw egg into the glass jar. Do NOT crack the egg.
2. Cover the egg with the clear vinegar.
3. Close the lid on the jar.
4. Observe immediately and then periodically for the next 24 hours.

**WHAT HAPPENED:** Vinegar's chemical name is acetic acid. Eggshells are made of calcium carbonate. The reaction between acetic acid and calcium carbonate causes the eggshell to dissolve and carbon dioxide bubbles to form.

Bubbles start forming on the surface of the eggshell immediately and increase in number with time. After 24 hours the shell will be gone and portions of it may be floating on the surface of the vinegar. The egg remains intact because of the thin see-through membrane around the outside. The yolk can be seen through the membrane.

## More Secret Messages!<sup>1</sup>

**Academic Standards:** Scientific Inquiry K.1, K.10, 1.1, 3.5, 5.3

**Objective:** To compare and explore items that allows you to create an invisible message that can later be revealed.

### Materials:

White paper	Paintbrushes
Lemon juice or milk	Water based paint
Heat lamp/bright light (not fluorescent)	
Candle pieces/Crayons (clear or white only)	

### Lemon Juice and Milk Messages

1. Use a paintbrush to paint a message on your paper with milk or lemon juice.
2. Let the message dry (this may take a while).
3. When the message is dry, hold it close to the light. If the bulb is warm enough, the milk or lemon juice will turn brown. Why do you think the milk and lemon juice turn color with heat?

### Crayons

1. Use a crayon or piece of candle to write a message on the paper.
2. Paint over the message with water based paint. The paper will absorb the paint, but the wax will repel it. Why does the wax repel the water? Does water do the same thing with any other substances you can think of?

**What Happened:** Both lemon juice and milk are mildly acidic and acid weakens paper. The acid remains in the paper after the juice or milk has dried. Lemon juice contains carbon. When the paper is held near heat the acidic parts of the paper, the carbon darkens, allowing you to read it.

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<sup>1</sup> [www.nationalgeographic.com/ngkids/trythis/ghostly\\_messages.html](http://www.nationalgeographic.com/ngkids/trythis/ghostly_messages.html)

## Heat It UP<sup>2</sup>

**Academic Standards:** Scientific Inquiry 3.5, 5.3; Physical Sciences 4.1, 4.5, 5.1, 5.2

**Objective:** To investigate how steel wool can produce heat through chemical reactions.

### Materials:

Jar and lid	Small Thermometer
Vinegar	Notebook
Pencil	Steel Wool

### Procedure:

1. Put the thermometer in the jar and close the lid.
2. Wait about 5 minutes and write down the temperature.
3. Remove the thermometer from the jar.
4. Soak a piece of steel wool in vinegar for one minute.
5. Squeeze the vinegar out of the steel wool pad. Wrap the steel wool around the bulb of the thermometer.
6. Place the thermometer and steel wool back into the jar and close the lid.
7. Wait 5 minutes.
8. Now take a look at the temperature. Record the temperature.
9. Compare the difference in temperatures.

**What Happened:** The vinegar removes any protective coating from the steel wool, allowing the iron in the steel to rust. Rusting is a slow combination of iron with oxygen called oxidization. When this happens, heat energy is released. The heat released by the rusting of the iron causes the temperature to increase.

A chemical reaction is the process in which one substance is chemically converted to another. All chemical reactions involve the formation or destruction of bonds between **atoms**. Chemical reactions include the rusting of iron and the digestion of food. Most chemical reactions give off heat. For example, chemical reactions that occur in digestion give off heat, which keeps our bodies warm and functioning.

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<sup>2</sup> "Steel Wool Generating Heat". Reeko's Mad Scientist Lab. 1997-2005.  
[www.spartechsoftware.com/reeko/Experiments/ExpSteelWoolGeneratingHeat.htm](http://www.spartechsoftware.com/reeko/Experiments/ExpSteelWoolGeneratingHeat.htm)

# CABBAGE CHEMISTRY

**ACADEMIC STANDARDS:** Physical Science 4.2

**OBJECTIVE:** To use red cabbage juice to test for acids and bases.

**MATERIALS TO PREPARE INDICATOR:**

Cooking Pot	Knife
Clean glass jar with lid	Several clean, clear glasses

**MATERIALS FOR TESTING:**

Lemon juice	Baking soda
Milk or cottage cheese	Vinegar
Water	Clear soda pop
Other substances as desired	

**PROCEDURE:**

1. Put cabbage in cooking pot and cover with cold water. Cook over medium-high heat until the water turns a deep purple-red.
2. Allow to cool. Pour liquid into jar. (The cabbage liquid can be kept in the refrigerator for several days.)
3. Pour equal amounts of liquid into each of the glasses.
4. One at a time, try adding a small amount of the materials for testing to each of the glasses.
5. Notice what happens in each glass.

**WHAT HAPPENED:** The red cabbage indicator turns pink when mixed with an acid, and blue-green when mixed with a base. The indicator remains reddish-purple when mixed with a neutral substance.

Red cabbage leaves have a type of pigment molecules called anthocyanins. Blueberries, flower petals, and other types of leaves also have anthocyanins in them. Anthocyanins are what turn maple leaves red in autumn. The color that we see changes depending on the level of acid or base that surrounds the anthocyanin molecules. This property makes it useful as an acid-base indicator.

## Kitchen Cupboard Slime

**Academic Standards:** Scientific Inquiry 3.3, 3.5; Physical Sciences 3.4, 4.2

**Objective:** To compare and contrast several types of slime: Flubber, Oobleck, Glarch, and COSI Super Slime.

**Materials:** For all three kinds of slime, you will need the following materials. You will also need additional supplies for each type of slime.

- 8 mixing bowls, quart size
- 8, 1 cup liquid measuring cups
- 8 measuring teaspoons
- 8 wooden mixing spoons
- 1 box of reseal-able bags for storage

**Warning:** ACTIVITIES ARE MESSY! COVER WORK SURFACES.

### Flubber

**Additional Materials** (for 25-30 students working in teams of 3-4):

- 8 cups school glue
- 1 cup powdered borax (found in the laundry section at most grocery stores)
- 1 box food coloring
- 1 gallon warm tap water
- Colored Newspaper

### Procedure:

1. Cover work area with newspaper/tablecloth (*included colored newsprint*).
2. Two team members should make the borate solution and two team members should make the glue solution.

Borate Solution:      2/3 cup warm water  
                                 1 1/2 teaspoon powdered borax  
                                 3 drops food coloring

Mix together in a 1-cup measuring cup using a wooden spoon.

Glue Solution:        3/4 cup warm water  
                                 1-cup white school glue

Mix together in a mixing bowl using a wooden spoon.

3. Pour the borate solution into the bowl with the glue solution.

## **Kitchen Cupboard Slime** (continued)

4. Use your hands to gently lift and turn the mixture until only one tablespoon of liquid is left. Flubber will be sticky for a moment or two. After the extra liquid has drained off the Flubber is ready.
5. Explore! Does it ooze between you fingers? Can you roll it into a ball? Does it bounce? Does it keep shape? What happens when you press it on the comics? What happens when you pull on it quickly?
6. Clean up and store the Flubber in a plastic bag.

**Storage and Disposal:** Store Flubber in a plastic bag in the refrigerator. When you are done with the Flubber discard it in a waste can. DO NOT wash it down the sink. If it dries on carpet or clothing, cover it with a vinegar-soaked cloth to de-gel it, then wash with soap and water. Always wash hands after handling each type of slime.

## **Glarch**

**Additional Materials** (for 25-30 students in groups of 3-4):

- 1 large bottle liquid starch
- 3 cups school glue
- Paper towels

### **Procedure:**

1. Cover work area with newspaper/tablecloth.
2. Get the following tools: mixing bowl, measuring cup, and wooden mixing spoon.
3. Measure  $\frac{1}{4}$  cup of liquid starch into the bowl.
4. Measure  $\frac{1}{4}$  cup white school glue into the same bowl.
5. Mix together with spoon. After the substance becomes too thick to stir use your hands. Knead or fold the mixture thoroughly with your hands. It may take several minutes to mix fully.
6. If the Glarch is sticky or stringy, you may need a few more drops of glue to make it like Silly Putty. After adding more glue you will need to continue mixing the Glarch.
7. Explore! Does it ooze between you fingers? Can you roll it into a ball? Does it bounce? Does it keep shape? What happens when you press it on the comics? What happens when you pull on it quickly?
8. Clean up and store the Glarch in a plastic bag.

**Storage and Disposal:** Store Glarch in a plastic bag in the refrigerator. When you are through with it, throw it in a trash container. Always wash hands after handling each type of slime.

## Kitchen Cupboard Slime (continued)

### Oobleck

#### Additional materials:

- 6 boxes cornstarch
- 2 quarts water
- 8 aluminum pie pans
- 8, ½-cup measuring cups

#### Procedure:

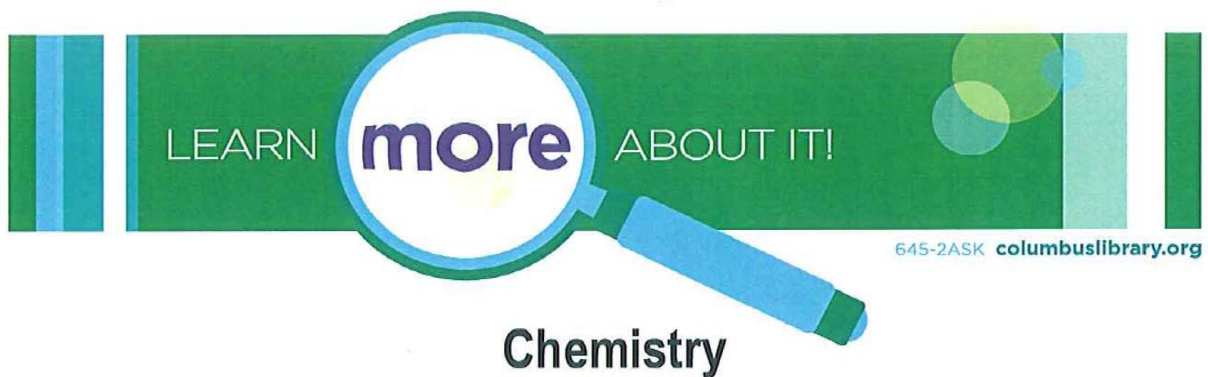
1. Cover work area with newspaper/tablecloth.
2. Place a pie pan in the center of the table.
3. Measure 1-½ cups of cornstarch and put it in the pie pan.
4. Add ½ cup of water to the cornstarch. Stir well (this will take time). Add small amount of water or cornstarch until you get a mixture that “tears” when you *quickly* scrape your finger through it and then “melts” back together again.
5. Explore! Does it ooze between you fingers? Can you roll it into a ball? Does it bounce? Does it keep shape? What happens when you press it on the comics? What happens when you pull on it quickly? What happens if you punch your hand into the Oobleck?
6. Clean up and store the Oobleck in a plastic bag.

#### Storage and Disposal:

Cover container of Oobleck with plastic wrap and refrigerate. When ready to dispose of it, let it set out to dry for several days, then discard in a trash container. DO NOT wash down the drain. Always wash hands after handling each type of slime.

**What Happened?** Slime is a polymer. Polymer molecules are in long chains. The more places where the chains stick together, the harder and more solid the polymer becomes (think of a bowl of wet spaghetti as it dries out!). Some examples of polymers are hair, fingernails, DNA, starch, rubber bands, credit cards, Silly Putty, Nerf Balls, and football pads.





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## Chemistry

Grades K-6

Books at the Columbus Metropolitan Library, 96 South Grant Ave.

### FICTION

- Rainy Day Music** by Judity Hyde, 2006. Picture Book HYDE  
Dad enlivens a boring, rainy day by playing "ghost fiddle," a musical activity involving water-filled glasses.
- Cloud Dance** by Thomas Locker, 2000. Picture Book LOCKER  
Enjoy these beautiful illustrations depicting clouds at different times of the day and year.
- Splash!** By Flora McDonnell, 1999. Picture Book MCDONNELL  
The elephant, tiger, and rhinoceros are all hot. That means it's time to splash around in the water and cool off!
- Water Boy** by David McPhail, 2007. Picture Book MCPHAIL  
Fascinated by the fact that humans are made mostly of water, a boy develops an unusual relationship with it once he stops being afraid.
- This is the Rain** by Lola Schaefer, 2001. Picture Book SCHAEFER  
Explore the water cycle with these rhyming refrains and interesting photo collages.

### NON-FICTION

- Experiments with Solids, Liquids, and Gases** by Salvatore Tocci, 2001. J507.8 T631e  
Simple experiments are accompanied by colorful pictures in this introduction to chemistry.
- Flash! Bang! Pop! Fizz!** by Janet Chahrour, 2000. J530.078 C433f  
Presents concepts and instructions for 25 chemistry experiments using simple materials.
- Change It! Solids, Liquids, Gases and You** by Adrienne Mason, 2006. J530.4 M398c  
Hands-on activities provide an easy way to learn chemistry facts.
- Pop! A Book About Bubbles** by Kimberly Bradley, 2001. J530.4275 B811p  
Vivid photographs and simple text capture the science behind this fun activity.
- Look How It Changes** by Jane Young, 2006. J541.39 Y73l  
Examples of basic chemical reactions are pictured and explained.



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