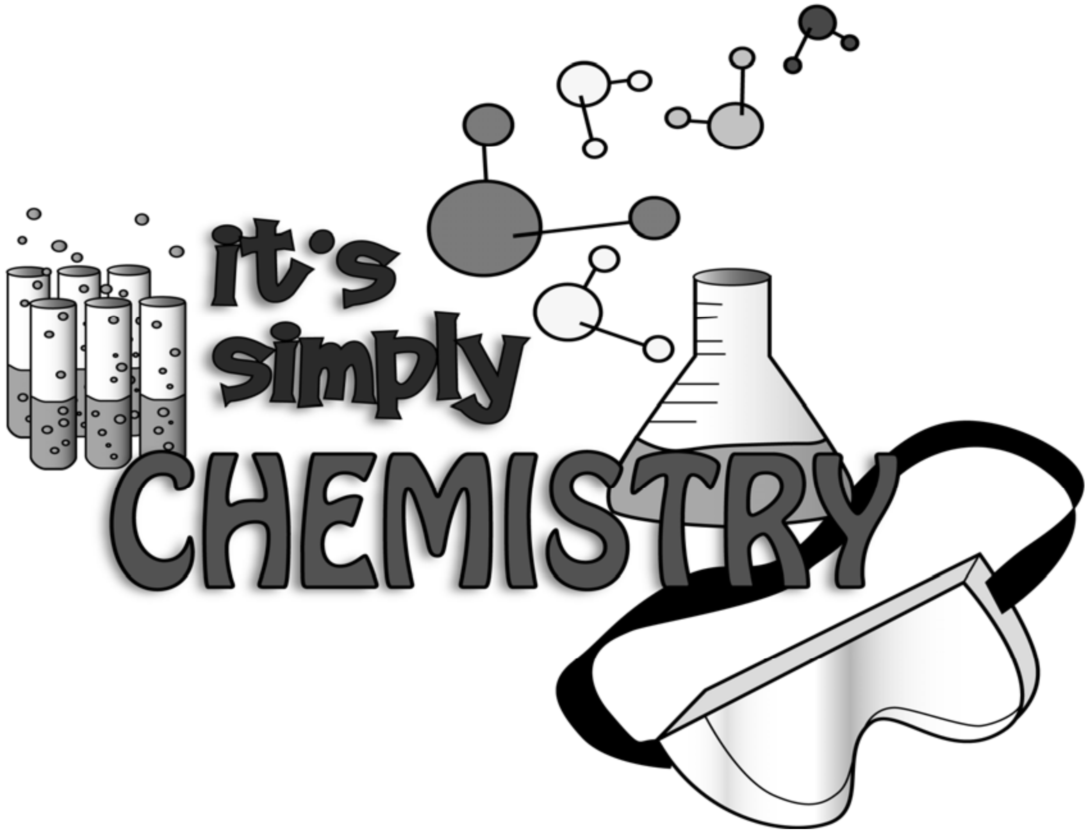
Center of Science and Industry



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
- Chemical Reactions in Your Mouth
- 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![1]

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

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.

[1] www.nationalgeographic.com/ngkids/trythis/ghostly_messages.html

Heat It UP[2]

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 though 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.

[2] "Steel Wool Generating Heat". Reeko's Mad Scientist Lab. 1997-2005. www.spartechsoftware.com/reeko/Experiments/ExpSteelWoolGeneratingHeat.htm

Chemical Reactions in Your Mouth –Spit Experiment!

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

Objectives:

Materials:

Liquid Iodine (the kind you get at a pharmacy) w/ Pipette for Dripping
Bread or Two Crackers (salt free soda crackers work best)
Wax Paper

Procedure:

<u>Safety</u>

Make sure you have an adult helping you.
DO NOT EAT any of the iodine - it's poisonous!

<u>Directions</u>

With your hands, crumble one of the bread/crackers on the wax paper and add a drop or two of iodine - what happens? (DO NOT EAT the bread/cracker with iodine on it)

Then take the second piece of bread/cracker (<u>not the one with iodine on it</u>) and chew it in your mouth - chew well - really get it nice and mushy. Here's the gross part... Don't swallow, spit the chewed up bread/cracker onto the second piece of wax paper.

Now, put a drop or two of iodine on the chewed up and spit out cracker. What happens?

What happened:

An enzyme in your spit starts digestion right away by converting the big starch molecules in your mouth to small little sugar molecules! Sugar doesn't turn black when added to iodine (try it!) so, there's no reaction! Gross, huh?

Limewater

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

Objectives: Students will make a limewater testing solution for carbon dioxide and explore the concepts of solubility and precipitates

Materials:

- Limewater (purchased or made)
- Tablespoon
- Jars w/ Lids
- Water

Procedure:

Making Limewater

Limewater is used in many science experiments and is easy to make on your own. Put 1 teaspoon of calcium hydroxide in a clean glass jar, up to 1 gallon in size. (Limewater is a saturated solution, which means there will be some extra chemical that doesn't dissolve. A teaspoon will result in a fully saturated solution whether you use a gallon jar or a smaller one.) Fill the jar with distilled or tap water. Shake the jar vigorously for 1-2 minutes, then let it stand for 24 hours. Being careful not to stir up the sediment, pour the clearer solution off the top of the jar through a clean coffee filter or filter paper. Repeat the filtering step if necessary to obtain a clear limewater solution. Store in a clean jar or bottle.

When carbon dioxide is bubbled into limewater, calcium carbonate (CaCO3) is produced. It precipitates out as a white suspended solid, making the solution appear cloudy.

To add carbon dioxide, stir the limewater and/or blow into the liquid using a clean straw. Be careful not to ingest any of the limewater. Yuck!

What Happened:

When carbon dioxide is bubbled through lime water, it can react with the lime to form calcium carbonate, and this forms as a solid in small particles that make the water

$CO_2 + Ca(OH)_2 \rightarrow CaCO_3 + H_2O$

Carbon dioxide reacts with calcium hydroxide (lime water) to form calcium carbonate and water. Calcium carbonate is insoluble therefore exist in the form of a white precipitate which turns the solution cloudy.

Chemical Breath

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

Objectives: Students will use their limewater as a test solution for carbon dioxide.

Materials:

Limewater or Bromothymol Blue
Small drinking glasses or beakers
Drinking straws
Water

Observations

Look at the bromthymol blue solution. Does it have color or is it clear? Do you think the color will change in the presence of carbon dioxide? If so, how?

Procedure:

1. Fill the glass about one-third-full with the water. Place a small amount of bromothymol blue into the water.
2. Ask the guest to bubble air through a straw into the solution. What happens? IMPORTANT: Do not allow the guest to ingest any of the water with bromthymol blue indicator in it.

What Happened?

Bromothymol blue is an indicator solution that is blue in the presence of bases, pale green when neutral, and yellowish with acids. The bluish water at first will appear to become very pale, to greenish, then yellowish. The carbon dioxide in a human's breath mixes with the water to form carbonic acid, indicated by the yellow color. So we can see that humans exhale carbon dioxide.

We all need oxygen to survive. But the truth is, we need carbon dioxide, too, because plants use this carbon dioxide that we exhale, combine it with ordinary water, and turn it back into…that's right, you guessed it…oxygen! This oxygen is actually a by-product of the really exciting things that plants do, though. Plants make something that we all love… sugar!!! But first, let's see how the sun's energy is important in the making of sugars.

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
- Clean glass jar with lid
- Knife
- Several clean, clear glasses

MATERIALS FOR TESTING:

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

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 ½ teaspoon powdered borax
   3 drops food coloring

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

   Glue Solution: ¾ 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 ¼ cup of liquid starch into the bowl.
4. Measure ¼ 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.

LEARN **more** ABOUT IT!

645-2ASK **columbuslibrary.org**

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.

COLUMBUS
METROPOLITAN
LIBRARY

Compiled by the Main Library's Center for Discovery
645-2ASK · 12/09