1996 National Chemistry Week

Cleveland Section of the AmericanChemical Society (ACS)

A CHEMICAL MYSTERY TOUR- CELEBRATING CLEVELAND'S BICENTENNIAL

This program was designed to help children in grades two through five celebrate Cleveland's Bicentennial and appreciate the contribution of chemistry in improving everyday materials. The children are presented with a "real" time capsule ("casket", to use the old terminology) filled with "authentic" 100-year old samples and a "fake" capsule filled with today's new materials that look exactly like the old ones. Which is 100 years old? By using the senses and analytical techniques the children are asked to make a reasonable guess, and then are given the correct answers!

Learn about the new superabsorbants (for diapers), buffered soaps, strong paper and yarns, water-insoluble inks, etc.!

Winner of the Phoenix Award (a national ACS award) honoring the best event in a library during National Chemistry Week.

The information and activities described here are intended as reference material and to commemorate the programs given at CCPL libraries in partnership with the Cleveland Section, ACS. Activities should be done by students only under the direct supervision of an adult such as science teacher or chemist. The authors, program committee members, anyone named in this script, and the ACS are not responsible for any injury or accidents resulting from conducting the experiments described herein. Please be aware that we have tried to minimize error in this script; any error is unintentional.

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Overview

This year's National Chemistry Week demonstrations revolves around solving a Cleveland mystery. It seems a local school district has discovered that 100 years ago students from the Broadway school buried a time capsule, or as it was called in their day, a "casket". A contest was started to "uncover" the time capsule. The time capsule was found. However, 6 time capsules were found. Hence, the mystery of solving which time capsule is the "authentic" one was born. Because you have chosen to accept it, your mission is to help the students discover which time capsule is real by identifying whether its contents are "100" years old, or whether they are more recent items. You and the students will do this by testing the properties of the objects that were found in the caskets:

- Ink
- Soap
- Paper
- Diapers
- Yarn
- Cookie Mix
- Material

How Experiments are Organized

Each experiment is divided into different parts:

- Background and Set-Up Information for Demonstrators
- Materials for This Experiment - Students
- Materials for This Experiment - Demonstrators
- Experiment Demonstration Pre-Work Set-Up
- Demonstration Instructions
- Experiment Conclusions & Answers
- Additional Information If Needed

Note: The program is designed for up to 30 children separated into up to 6 groups.

Presentation Overview

This section describes the basic presentation technique used during the demonstrations. This is a guideline only, as some experiments are different. Make sure you follow the instructions given in each experiment.

1. Introduce experiment.
2. Do your demonstration piece and make the standards.

   Note (1): Each experiment involves you testing all the materials so the students will have a model to determine their result - these results are called the standards.

   (2): Some experiments have the students do the experiment first, and then while determining the results, the demonstrator does the experiment. Make sure to follow the instructions given in each experiment.
3. Have the students do their "discovery" experiment, and record their observations on the Discovery Sheet under "What we saw".
4. Have students compare their observations (results) to the standards you made and have them write whether the result was positive or negative.

   Note : Contrary to what we're used to thinking, a positive results does not necessarily mean that the sample being tested is "100" years old. For these demonstrations, a positive results only means that they saw the result that we classified as positive. Why did we do this? Because we don't want the students who have the fake time capsules to discover this early on and lose interest. Please stress to the students what a "positive" result means.

> ***DO NOT SHARE CONCLUSIONS AT THIS TIME!***
> ***WAIT UNTIL ALL EXPERIMENTS ARE COMPLETE!***
>
> *It is important to complete all the experiments before revealing how a "100" year old material would behave in the experiment versus a newer material. At this point in the experiments, nothing is "old" and nothing is "new". The students are simply testing the different properties of various samples.*
>
> ☞ *We want to have the students make all their observations first before drawing a hypothesis on the materials within their time capsule (just like we do n the lab).*
>
> ☞ *Also, by waiting until the end to determine if their time capsule is the real one or not, they are able to hold interest in the experiments and not feel bad and become disinterested when they do not have the "authentic" one.*

5. Repeat Steps [1] - [4] for all the experiments.
6. Share the conclusions for the first experiment, and have them determine if their sample was authentic or not (record yes under authentic).
7. Repeat Step [6] for all the experiments.
8. Ask them to look at their Discovery sheet and determine whether their time capsule was authentic or not.

MAKE SURE TO FOLLOW ALL DIRECTIONS IN EXPERIMENTS

Time Capsule Identification: Authentic vs. Fraudulent

- If more than one table of students concludes their casket is authentic, verify that they correctly concluded authenticity from the results. DO NOT QUESTION their results. If all are correct, explain that we are never able to prove, only disprove. In this case, we successfully disproved all but two of the caskets to be authentic. That is to say, only if there is a modern material present can we say for sure that the casket is not authentic.
- If no table identifies their casket as authentic, DO NOT QUESTION table one* specifically. Go through the conclusions again to verify that everyone correctly identifies the authenticity of their results. If still no one identifies their casket as authentic, ask them what this means. If no one mentions it, tell them it means that the real casket is still buried somewhere and all of the caskets submitted were fakes.

* Table One has the casket with all "authentic" materials.

Demonstration Check-Off List

Below are some guides that you may find helpful in organizing the activities that you need to do before, during, and after the demonstration.

Activities To Do Before You Go To The Demonstration	✓ When Complete
Read through this information packet to familiarize yourself with the experiments	❑
Collect the materials you need to bring with you to the demonstration: ➢ This packet ➢ The demonstration kit with 6 small boxes (the caskets) ➢ 1 gallon jug for waste water collection ➢ 1 roll of paper towels ➢ Sharpie-type pen ➢ 250 ml white vinegar ➢ 1 large garbage bag	❑
Contact the children's librarian: ➢ Ask the room to be arranged with 6 tables around a front table ➢ Ask to have 6 chairs around each of the 6 tables ➢ Ask for all the tables to be covered with newspapers	❑

Activities To Do When You Get To The Library	✓ When Complete
Introduce yourself to the children's librarian	❑
Ask the librarian how many students are pre-registered	❑
Confirm that there are 6 student tables and 1 demonstrator's table	❑
Confirm that all tables are covered in newspaper	❑
Set out the individual time capsules and 1896 welcome letters on the students' tables	❑
Complete Demonstration Pre-Work Set-Up for all demonstrations: ➢ Ink - Chromatography ➢ Soap ➢ Paper ➢ Diaper Absorbency ➢ Yarn ➢ Cookie Mix ➢ Material Dissolution *Note: This set-up is estimated to take 45 minutes.*	❑
Set out the literature	❑
Put on both NCW buttons	❑

Activities To Do During The Demonstration	Timing
Welcome the students and parents as they enter the room	-
Assess number of students per table and the distribution of the time capsules *Note: There should be between 3 - 6 students per table. Move the students around until you achieve this ratio. If you have extra tables, remove casket 6, 5, and so on; removing these will eliminate the number of fake caskets.*	-
Complete the Opening Session introduction	5 min.
Perform time capsule demonstrations and determine positive/negative test result	*Total Time: 43 min.*
➢ Chromatography - Start	7 min.
➢ Soap	3 min.
➢ Paper	2 min.
➢ Chromatography - Remove From Water	3 min.
➢ Diaper Absorbency - Start	2 min.
➢ Yarn	3 min.
➢ Cookie Mix - 5 Experiments	20 min.
• Solubility	
• pH Measurement	
• Iodine Test (starch)	
• Limited Vinegar Test (baking soda)	
• Excessive Vinegar Test (washing soda)	
➢ Material Dissolution	3 min.
Share conclusions and answers for each demonstration - determine authenticity of each sample ☞ *Remember to complete the reading of the chromatogram* ☞ *Remember to assess test result for diaper absorbency*	10 min.
Complete the Closing Session information	2 min.
Optional Encore Experiment - Soap vs. Detergent (only if time)	5 min.
Tell the students there is literature and to pick some up	0.5 min.
Thank everyone for coming	0.5 min.

Activities To Do Immediately After The Demonstration	✓ When Complete
Transfer all liquids to the 1 gallon waste jug	❑
Transfer all solids to the garbage bag	❑
Remove newspapers from the tables and put in the garbage bag	❑
Give any left over literature to the librarian	❑
Record the number of adult and student participants	❑

Activities To Do Once You Get Home	✓ When Complete
Pour waste liquid from 1 gallon jug down the drain	❑
Put garbage bag in the trash	❑
Clean and dry all vials	❑

Note: All materials are typical household products. They can be safely disposed of in the manner indicated above.

Opening Discussion

Introductions

Do the following:

- Introduce yourself as a chemist.
- Introduce the American Chemical Society as the largest single profession organization in the world.
- Introduce National Chemistry Week - what it is and why we do it.

(Hint: it is an event put on all across the country by volunteers like you to let non-chemists know about chemistry and how chemistry and chemists influence their lives.)

What is Chemistry and Chemicals?

Do the following:

- Explain that chemistry is the study of everything around them.
- Ask for volunteers to name some chemicals. Then ask more volunteers to name something that isn't a chemical.

> ***Remember: everything around us is a "chemical".***
> *Be very careful in correcting them. Encourage their participation while explaining that their idea really is a chemical.*

What Do Chemists Do?

- Ask the participants to tell you what a chemist does, what a chemist looks like.

Note: *Be prepared for some strange and funny answers. Try not to laugh, cry, or get offended.*

- Tell them BRIEFLY and in simple terms what you do as a chemist.

Note: *This should last no more than 1 minute. Remember to leave the physical chemistry lecture and the "big" chemistry words at home!*

- Tell them that chemists use their knowledge to answer questions about the world around them. This is very exciting, as they will soon see.

Demonstration Introduction

Get Them Roped Into Solving the Cleveland Mystery

Do the following:

- Tell them that a very interesting mystery has been uncovered in Cleveland and you need their help to solve it.
- They can help solve the mystery by becoming chemists for the next hour. Ask them if they want to help (hopefully they affirm with glee).

Tell the Story of the Discovered Time Capsule

Do the following:

- Tell the story:

You may have heard that 200 years ago in 1796, Moses Cleveland settled on the shores of Lake Erie at the mouth of the Cuyahoga river. Since then, a thriving town developed and became the industrial powerhouse of today's Cleveland. In this bicentennial year, much has been said and done commemorating Moses Cleaveland and 1796. However, what was done in 1896, when Cleveland celebrated it's 100th birthday is largely forgotten. Clevelanders were justifiably proud of their city 100 years ago. Just as we celebrate the bicentennial now, they celebrated the centennial back then. A part of that celebration has become cloaked in mystery. A mystery that we will solve today.

The students at the old Broadway school celebrated the past by trying to speak to the future. They buried a time capsule, they called them "caskets" at the time, that had many things from their daily lives:

- a girl's doll baby, complete with dress and diaper
- several letters to students of the future
- a bar of soap (obviously some boy trying to get out of taking his bath)
- and some cookie mix from a father's bakery

Over the past 100 years, people forgot where the time capsule was buried. Before the old Broadway school was torn down, the librarian did manage to save the list of what the students placed in the time capsule. Six months ago, the school district ran a promotion to have people in the community find the missing time capsule. The promotion was a great success! The time capsule was found! In fact 6 time capsules were found. This was a problem because the librarian knew that only 1 of the time capsules could be the real one. But which one was it? All the things in the time capsules looked the same and so the mystery of trying to figure out which time capsule was the real one began.

How can we discover the truth, and fill in the missing blank in Cleveland's history? *Chemistry is the answer.* A lot has changed since the real time capsule was buried. Because of technology, we have different things today than the students had 100 years ago. If some of the materials in a time capsule were not around 100 years ago, then that capsule must be a fraud and have been created recently. The only time capsule that could be real is the one that contains things that were around 100 years ago. So, let's become chemists and make observations and use our knowledge to solve the mystery of finding the real 100 year old time capsule.

Introduce The Time Capsules

Do the following:

- Tell them that on their tables is a box that has small pieces of items from the different caskets that were found.

  Note: If anyone objects to or questions using 100 year old materials for these test, assure them that only a small portion of the material in the time capsule has been taken. The potential damage done in determining the truth and solving the mystery by destroying some materials is less damaging than not knowing the truth.

- Ask them to open up the box and to look inside, but not to touch anything.
- Tell them that they are now going to start solving the mystery.
- Tell them that they will examine various properties of materials from the caskets.
- Tell them that this is the first step in the scientific method: observation.
- Tell them that they will make and test hypotheses after the observations.

Chromatography Experiment

Background and Set-Up Information For Demonstrators

Experiment Purpose & General Methodology

- The chromatography experiment involves discovering whether or not an ink mark made on a piece of paper is 100 years old.
- Paper strips with an "ink" question mark are placed in water, left in until the water level reaches the lip of the cup, and removed to dry. The chromatograms are then examined and results are noted.
- The students will test 1 paper strip; the demonstrator will test 2 paper strips.

Materials For This Experiment - Students

- 6 paper strips with an ink question mark on it (1 contained in each time capsule)
- 6 tall paper cups (contained in demonstrator's kit)
- 6 pencils (contained in demonstrator's kit)
- Tap water

Materials For This Experiment - Demonstrators

- 2 paper strips with an ink question mark on them
- 2 tall paper cups
- 1 pencil
- Tap water

Chromatography Demonstration Pre-Work Set-Up

Do the following:

- Remove 8 tall paper cups from demonstrator's kit
- Put 1 cup on each of the Students' tables
- Put 2 cups on demonstrator's table
- Fill all cups to a depth of 1/4" (0.5 cm) tap water
- Put the 2 demonstrator paper strips by the 2 demonstrator cups
- Place one paper towel on each of the Students' tables
- Place one paper towel on demonstrator's table

Chromatography Demonstration

Introduce the Experiment

Tell the students the following:

- In the time capsules letters were found that were written by the students. Analyze inks.
- Inks have changed over the years. Inks are made of several different chemicals. Some of these chemicals have different colors. They all have different properties. One of these differences is their ability to run on paper. We will use this property to evaluate samples of a note included in the time caskets.

Perform the Chromatography Demonstration Simultaneously With the Students

Part I - Develop the Chromatograms

Do the following:

- Pick up the demonstrator's long strip of paper with the question mark.
- Tell the students to look in their time capsule, find the strip of paper that looks like yours, and take it out.
- Pick up the pencil and draw a line on the paper through the question mark, and show the students what it looks like.
- Tell the students to pick up a pencil and draw a line through the question mark like you did.
- *(Note: You will do both chromatograms at the same time. While they're working on what you just showed them, complete the steps for the other paperstrip. Do not reveal to the students which sample is "old" or "new".* Tell the students that they are just 2 different types of ink that are available. You are simply generating information on behavior of different inks.*)*
- Carefully put the strip of paper into the tall plastic cup, being careful not to get the question mark in the water, and fold any excess paper over the lip of the cup.
- Tell the students to do the same.
- After the chromatograms are started, tell the students that it will take some time for this experiment to finish and to move the cup aside so we can move on to the next experiment while were waiting for this one to get done.

  Note: The chromatograms will take 5 - 10 minutes to develop. Watch your chromatograms and take them out when the water nears the top of the strip.

Part II - Complete the Chromatograms

Do the following:

- When you return to the chromatograms, tell the students to remove the strip of paper from the cup and lay it on a paper towel to dry. Remove yours from the cups as well.

Part III - Read the Chromatograms For Test Result After All Demonstrations Are Complete

Do the following:

- Ask students to look at the pencil mark, and see if the ink has moved away from it.
- Ask them to write what they see in the chromatography observation section of their Discovery sheet (point out to them where they should write it).
- Show them one of your chromatograms and point out where the ink is on it.

If ink has:	Then result is:
Moved away from pencil mark	Positive
Stayed in its original position	Negative

- Ask the students to raise their hands if their chromatogram looked like yours; tell them to put a check mark in the appropriate (positive or negative) box
- Show the students your other chromatogram and repeat positive/negative results analysis.

Chromatography Conclusions & Answers

REMEMBER DO NOT SHARE CONCLUSIONS UNTIL ALL EXPERIMENTS ARE COMPLETE!

Tell the students the following:

- Black ink is made of many different colored dyes. When they are all mixed, they appear black. When they are separated, the original colors can be seen.
- Chromatography, or "color writing" takes advantage of the fact that the different dyes "stick" to paper differently. As the water soaks into the dry paper, it carries the dyes along with it. The more a dye "sticks" to the paper the less it moves.
- 100 years ago, all the available dyes and inks were water based. Non-water based inks have been developed since 1896.

Do the following:

- Hold up your 2 chromatograms and ask the students which one of them is more likely to have ink that is water based (the positive - ink moved).
- Ask the students which chromatogram had the modern ink on it (the negative - ink didn't move).
- Ask the students to look on their Discovery Sheet and look to see what their result was.
- Ask those students to raise their hands who had a positive result (the ink moved) - tell them to check the authentic box on their Discovery Sheet.
- If the spot on your note did not move (a negative), it can't be 100 years old.

Additional Information If Needed: Chromatography Technical Background

- Chromatography is an analytical technique that can be used to determine the presence of small amounts of samples.
- It is often used in forensic chemistry and in authenticating inks on old documents.

Soap Experiment

Background and Set-Up Information For Demonstrators

Experiment Purpose & General Methodology

- The soap experiment involves discovering whether or not a sample of soap is 100 years old.
- A piece of pH paper is dipped in water and then placed on the soap.
- The students will test 1 soap sample; the demonstrator will test 2 soap samples.

Materials For This Experiment - Students

- 6 soap samples wrapped in paper (1 contained in each time capsule)
- 6 pieces of c paper (contained in demonstrator's kit)
- 6 color codes for Hydrion® or pH paper (contained in demonstrator's kit)
- Tap water in a cup from any experiment yet to be done

Materials For This Experiment - Demonstrators

- 1 soap sample wrapped in paper
- 1 soap sample in plastic weigh boat
- 2 pieces of Hydrion® or pH paper
- 1 color code for Hydrion® or pH paper
- Tap water in a cup from any experiment yet to be done

Soap Demonstration Pre-Work Set-Up

Do the following:

- Put the 2 soap samples in the demonstrator's kit on the demonstrator's table.
- Put the 2 pieces of Hydrion® or pH paper and the color code paper that are in the demonstrators kit on the table next to the soap samples.
- Put 1 hydrion color decoder on each of the students' table
- Put 1 piece of Hydrion® or pH paper on each of the students' table

Excess Vinegar (Washing Soda) Experiment

Tell the students the following:

- If an excess of vinegar is added, all the bicarbonate from the baking soda will have reacted and will not fizz anymore.
- However, the carbonate will have changed to bicarbonate and so will fizz.
- Washing soda is sodium carbonate.

Do the following:

- Ask the students what would happen if too much vinegar is added to baking soda.
- Tell the students that if their solution fizzed with excess vinegar (a positive) then it contained washing soda. It can't be a real cookie mix.
- Ask the students to look on their Discovery Sheet and look to see what their result was.
- Ask those students to raise their hands who had a negative result (the solution did not fizz) - tell them to put a check mark in the authentic box on their Discovery Sheet.

Additional Information If Needed: Technical Background

- Sodium salts and small organic molecules are soluble in water {salt (NaCl), baking soda ($NaHCO_3$), washing soda (Na_2CO_3), and sugar ($C_6H_{12}O_6$)}. Larger organic molecules and silicates {corn starch, flour and talc} are not.

- The pH of solutions containing carbonate and bicarbonate salts (baking soda and washing soda) are basic. The organic materials and salt do not greatly effect pH.

  $H_2O + NaHCO_3 \rightarrow OH^- + H_2CO_3 + Na^+$ and

  $H_2O + Na_2CO3 \rightarrow OH^- + HCO_3^- + 2Na^+$

- Iodine bonds tightly to starch to form a dark blue or purple complex. If the starch is in solution, this gives rise to a purple appearance. If the starch is a finely divided colloidal or particulate suspension, then the iodine only bonds to the surface, giving the particles a black appearance.

- Vinegar is a solution of acetic acid in water. The acid forces the reactions given above to go toward completion. With bicarbonate, the vinegar produces carbonic acid, which decomposes to yield carbon dioxide gas and water:

  $H_2CO_3 \rightarrow H_2O + CO_2$

  The carbon dioxide gas is what is seen as bubbles. With carbonate, the vinegar first produces bicarbonate. Additional vinegar then produces carbonic acid and carbon dioxide from the bicarbonate. This two stage reaction, each stage requiring vinegar, is why the excess vinegar is required to form bubbles with the washing soda.

Iodine (Starch) Experiment

Tell the students the following:

- Iodine reacts strongly with starchy materials to turn a purple color.
- White flour contains starch and will react with iodine.

Do the following:

- Ask the students what a non-colored solution means.
- Tell the students that if their solution did not turn purple with iodine (a negative), then their cookie mix does not contain flour. It can't be the real cookie mix.
- Tell the students that in addition to flour, other materials will also turn purple with iodine, such as corn starch or laundry starch. So, just because the solution turned purple, doesn't necessarily mean the cookie mix contained flour, it could also contain corn starch or laundry starch.
- Ask the students to look on their Discovery Sheet and look to see what their result was.
- Ask those students to raise their hands who had a positive result (their solution turned purple) - tell them to check the authentic box on their Discovery Sheet.

Regular Vinegar (Baking Soda) Experiment

Tell the students the following:

- Vinegar reacts strongly with bicarbonate to produce carbon dioxide gas bubbles.
- Baking soda is sodium bicarbonate, so it will fizz when vinegar is added.
- In addition to baking soda, other materials will fizz with vinegar, such as baking powder.

Do the following:

- Ask the students what would happen if the vinegar is added to the baking soda. Ask them what this means about their results.
- Tell the students that if their solution did not fizz (a negative), then it does not contain baking soda. It can't be a real cookie mix.
- Ask the students to look on their Discovery Sheet and look to see what their result was.
- Ask those students to raise their hands who had a positive result (the solution fizzed) - tell them to put a check mark in the authentic box on their Discovery Sheet.

Cookie Mix Conclusions & Answers

REMEMBER DO NOT SHARE CONCLUSIONS
UNTIL ALL EXPERIMENTS ARE COMPLETE!

Solubility Experiment

Tell the students the following:

- A cookie mix will contain white flour, baking soda, salt, and sugar.
- Other white powders found around the home will behave differently.
- The white flour is not soluble in water. Baking soda, salt, and sugar are all soluble in water.

Do the following:

- Ask the students what a clear liquid would mean (it means no flour).
- Tell the students that if their entire sample dissolved in water (a positive), then that mix can't contain flour. It can't be a real cookie mix. In addition to flour, other materials will not dissolve in water, such as corn starch and baby powder.
- Ask the students to look on their Discovery Sheet and look to see what their result was.
- Ask those students to raise their hands who had a positive result (their solution was cloudy) - tell them to check the authentic box on their Discovery Sheet.

pH Experiment

Tell the students the following:

- Cookie mix contains baking soda.
- Baking soda is slightly basic. Therefore, the pH of the mixture in water will be above 7.
- Flour, sugar, and salt will not effect the pH measurement. . So, their cookie mix may or may not be real yet.

Do the following:

- Ask the students what a pH of 7 would mean.
- Tell the students that if the pH of their solution is not above 7 (a negative), then that mix can't contain baking soda. It can't be a real cookie mix.
- Tell the students to keep in mind that in addition to baking soda, other materials will make the pH climb above 7, such as washing soda and baking powder. So, their cookie mix may or may not be real yet.
- Ask the students to look on their Discovery Sheet and look to see what their result was.
- Ask those students to raise their hands who had a positive result (their solution had a pH above 7) - tell them to check the authentic box on their Discovery Sheet.

Students Perform the Cookie Mix Excess Vinegar (Washing Soda) Experiment First, Then You Demonstrate While Testing for Result

Part I - Test for Baking Soda - Students ONLY

Do the following:

- Pick up one of your cups labeled EXCESS VINEGAR.
- Tell the students to find on their table the cup labeled EXCESS VINEGAR that looks like yours.
- Tell the students to dump the EXCESS VINEGAR into their cookie mix and water mixture and watch what happens. DO NOT DO THIS ONE SIMULTANEOUSLY!
- Tell the students to record what they saw in the excess vinegar observation section on the Discovery Sheet (point out where they should write it).

Part II - Test for Washing Soda (Demonstrator ONLY) & Read for Test Result

Do the following:

- Tell the students that you are going to put the EXCESS VINEGAR into your cookie mix and water mixture; do it and shown them what happens (i.e. show them it is bubbling/fizzing or not).

If solution:	Then result is:
Bubbles (sample 4-)	Positive
Fizzes (sample 4-)	
Does nothing (sample 4+)	Negative

- Ask the students to raise their hands if their solution reacted like yours; tell them to put a check mark in the appropriate (positive or negative) box
- Add EXCESS VINEGAR to remaining 4+ or 4- sample, show them what happens and repeat positive/negative results analysis.

Students Perform the Cookie Mix Regular Vinegar (Baking Soda) Experiment First, Then You Demonstrate While Testing for Result

Part I - Test for Baking Soda - Students ONLY

Do the following:

- Quickly put your 4+ and 4- samples into the two of the small clear plastic cups, and stir.
- Pick up one of your cups labeled REGULAR VINEGAR.
- Tell the students to find on their table the cup labeled REGULAR VINEGAR that looks like yours.
- Tell the students to dump the REGULAR VINEGAR into their cookie mix-and-water mixture and watch what happens. DO NOT DO THIS ONE SIMULTANEOUSLY!
- Tell the students to record what they saw in the vinegar observation section on the Discovery Sheet (point out where they should write it).

Part II - Test for Baking Soda (Demonstrator ONLY) & Read for Test Result

Do the following:

- Tell the students that you are going to put the REGULAR VINEGAR into your cookie mix-and-water mixture; do it and shown them what happens (i.e. show them it is bubbling/fizzing or not).

If solution:	Then result is:
Bubbles (sample 4+)	Positive
Fizzes (sample 4+)	
Does nothing (sample 4-)	Negative

- Ask the students to raise their hands if their solution reacted like yours; tell them to put a check mark in the appropriate (positive or negative) box
- Add REGULAR VINEGAR to remaining 4+ or 4- sample, show them what happens and repeat positive/negative results analysis.

Perform the Cookie Mix Iodine (Starch) Demonstration Simultaneously With the Students

Part I - Test for Starch

Do the following:

- Quickly put your 3+ and 3- samples in two of the small clear plastic cups, and stir.
- Tell students that you are going to put 5 drops of iodine in each of your samples and ask them to watch what happens; do it and stir.

REMEMBER - IODINE IS A POISON.
DO NOT LET STUDENTS HANDLE THE IODINE.

- Tell the students that you are going to come around and put 5 drops of iodine in their cookie mix and water mixture. As you are doing this, tell the students not to play with the cups after the iodine is added because it will stain their clothes.
- Tell students to stir the mixture and record their observations in the iodine section of the Discovery Sheet (point it out to them).

Part II - Read the Solution Color for Test Result

Do the following:

- Show the students one of your colored solutions.

If solution color is:	Then result is:
Colorless (sample 3-)	Negative
Black specs (sample 3+)	Positive
Purple to any degree (sample 3+)	

- Ask the students to raise their hands if their solution looks like yours; tell them to put a check mark in the appropriate (positive or negative) box
- Show the students your other solution and repeat positive/negative results analysis.

Note: Some of these results may change with the addition of vinegar. Revisit this after adding the vinegar.

Part II - Determine Solubility Test Result

Do the following:

- Show the students one of your samples.

If solution is:	Then result is:
Clear (sample 1-)	Positive
Cloudy (sample 1+)	Negative

- Ask the students to raise their hands if their solution looks like yours; tell them to put a check mark in the appropriate (positive or negative) box
- Show the students your other solution and repeat positive/negative results analysis.

Perform the Cookie Mix pH Demonstration Simultaneously With the Students

Part I - Test the pH

Do the following:

- Quickly put your 2+ and 2- samples in two of the small clear plastic cups, and stir.
- Pick up 1 of the demonstrator's pieces of hydrion paper, and tell the students to find the paper on their table.
- Tell the students to dip the pH paper into their solution to measure the pH of the cookie mix and water mixture; demonstrate simultaneously on the 2+ or 2- solution.
- Tell the students to write what they see in the cookie mix pH observation section on the Discovery Sheet (point out where they should write it).
- While students are observing, complete the pH measurement for the remaining 2+ or 2- sample.

Part II - Read the pH For Test Result

Do the following:

- Show the students one of your pieces of hydrion paper and compare it to the color decoder.

If color of hydrion paper best matches:	Then result is:
Color on the decoder labeled 9 or higher (sample 2+)	Positive
Color on the decoder labeled 8 or lower (sample 2-)	Negative

- Ask the students to raise their hands if their paper strip looks like yours; tell them to put a check mark in the appropriate (positive or negative) box
- Show the students your other paper strip and repeat positive/negative results analysis.

Cookie Mix Demonstration

Introduce the Entire Experiment

Tell the students the following:

- The father of one of the students at the old Broadway School had his own bakery. His cookies were the students' favorite treats.
- The baker was persuaded to include a small portion of his cookie recipe into the time capsule. That is the white powder in the bag marked A - F in the boxes.
- We are now going to conduct several tests on this white powder and several other white powders that might be commonly found around the home in order to try and figure out which is the 100 year old cookie mix.

Do the following:

- Tell the students to find the cookie mix sample in their time capsule.

Perform the Cookie Mix Solubility Demonstration Simultaneously With the Students

Part I - Powder Dissolution

Do the following:

- Tell the students to find the clear plastic cup, open up their cookie mix bag, and dump the cookie mix into the water; demonstrate simultaneously with either sample 1+ or 1-.
- Tell the students to take their stirrer and stir the cookie mix and water around; demonstrate simultaneously.
- Tell the students to write down their observation in the cookie mix solubility section on their Discovery Sheet (point out to them where to write).
- As they are stirring and recording, complete your remaining 1+ or 1- sample.

Cookie Mix Demonstration Pre-Work Set-Up

Do the following:

- Remove 14 clear plastic cups from the demonstrator's kit. Put 1 cup on each of the students' tables. Put 8 cups on the demonstrator's table. Fill all water cups with 75 ml of tap water.
- Remove 8 pieces of hydrion paper from the demonstrator's kit and put 1 on each of the students' tables and 2 on yours.
- Remove 14 coffee stirrers from the demonstrator's kit and put 1 coffee stirrer on each of the students' tables, and 8 on yours.
- Remove 8 small paper cups from the demonstrator's kit, and label them REGULAR VINEGAR with the Sharpie-type pen. Fill each cup with 15 ml (1 TBS.) vinegar. Put 1 cup on each of the students' tables, and 2 on yours.
- Remove 8 small paper cups from the demonstrator's kit, and label them EXCESS VINEGAR with the Sharpie-type pen. Fill each cup with 15 ml (1 TBS.) vinegar. Put 1 cup on each of the students' tables, and 2 on yours.
- Remove the 1+,- through 4+,- samples from the demonstrator's kit and put them on your table.
- Remove the tincture of iodine bottle from the demonstrator's kit and put on your table.

Cookie Mix Experiment

Background and Set-Up Information For Demonstrators

Experiment Purpose & General Methodology

- The cookie mix experiment involves discovering whether or not some cookie mix found in the time capsule contains real food ingredients.
- This experiment is made up of 5 mini-experiments. The cookie mix is added to water, and then tested for solubility, pH, starch, baking soda, washing soda.
- The students will test 1 cookie mix; the demonstrator will test 8 cookie mixes.

Materials For This Experiment - Students

- 6 cookie mixes in plastic bags labeled A - F (1 contained in each time capsule)
- 6 clear plastic cups (contained in demonstrator's kit)
- 6 pieces of hydrion paper (contained in demonstrator's kit)
- 6 color decoders for hydrion paper (contained in demonstrator's kit)
- 6 coffee stirrers (contained in demonstrator's kit)
- 12 small paper cups (contained in demonstrator's kit)
- 180 ml (12 TBS) white vinegar

Materials For This Experiment - Demonstrators

- 4 small plastic bags of "positive reaction" cookie mix labeled 1+ through 4+
- 4 small plastic bags of "negative reaction" cookie mix labeled 1- through 4-
- 8 clear plastic cups
- 2 pieces of hydrion paper
- 8 coffee stirrers
- 1 tincture of iodine bottle
- 4 small paper cups
- 60 ml (4 TBS) white vinegar
- Sharpie-type pen