***BibbidiBobbidi Boo – Magical Science Transformations***

This curriculum unit is recommended for:
*Elementary students grades 1-3*

**Keywords:** chemistry, children's fiction, experiments, chemical change

**Teaching Standards:** See Appendix 1 for teaching standards addressed in this unit.

**Synopsis:** Do you love magic? I know I do! At the end of a show, I'm always trying to figure out how they did those tricks! If you are like me, perhaps these lessons will fit nicely into your curriculum. This unit is a highly engaging science and literacy unit. It couples quality children's literature to fascinating science experiments. All of the experiments appear to happen as if by magic. The idea of this unit is to explain the magic behind several hands-on science experiments. By connecting the literature to the science discoveries, the children end up having a strong tie to the story while building their foundation of important science concepts such as chemical and physical changes, acids and bases, polymers, and more. The appeal of this unit is that you can teach the experiments separately according to what you are studying or you can teach it as a full unit of study. The experiments cover topics that are taught in upper grades while the stores appeal to children in the lower grades. It is versatile and can be easily be adapted to fit the needs of your learners.

*I plan to teach this unit during the coming year to* 48 students in first grade literacy and science.

**BibbidiBobbidi Boo: Magical Science Transformations**

by Lisa Lewis

## Introduction

Who doesn't love a good magic show? I remember getting to stay up late to watch David Copperfield's special show on TV. There is something awe-inspiring about seeing a magic trick performed. Even though you know there is a logical explanation to accompany what you are seeing, audiences will still pour in to see it. I have the privilege of working with students that find every-day things magical and they don't question it! They love seeing amazing things happen right before their eyes. This is why they all say that their favorite subject is science! When else do you get to see one thing and then, PRESTO, it's changed into something else. My goal for this unit is to have loads of fun with my students, get them excited and engaged about each activity, and then show them the awesome science at work whichmakes it all possible. This unit it not only to get them excited about science, but I hope it builds the foundation for future engineers, doctors, and chemists!

I have always loved the story Cinderella, and whether my students like it or not, I share the story with them every year. We identify the story elements and compare the story to other versions. I am always sure to include several versions where a male is the main character and where they get to fight, so that the boys get excited about our Cinderella study as well. One part that they all enjoy is how the Fairy Godmother transforms Cinderella, the pumpkin, and the mice, into something else using her magic. This is where the science comes in. I was thinking that because they are so fascinated with the "magic" in the book, that they would really enjoy participating in some science experiments where things appear to be happening as if by magic.

There are not any direct Common Core Standards for first grade that connect to chemistry. Therefore, I am going to meet literacy objectives through this unit by studying the different versions of Cinderella and connecting to the idea of magic in stories by incorporating fun science activities that seem magical. While the students participate in those activities, I will explain the magic behind them to provide them with a stronger sense of science concepts that will help them in the future.

The Cinderella study will be the catalyst for my unit. After reading several versions of the story, we will begin to explore magical science experiments. I have paired engaging fiction stories that contain a "magical" element with an experiment that would connect with the story. This unit will take two full weeks to complete. There is a demonstration or a hands-on experiment for all ten fiction stories.

I teach first grade at a full immersion Dual-Language program. My school is comprised of a diverse population of students. 13% are African American, 60% are Hispanic, 19% are White, and 8% range from Asian to Indian-American. Our LEP (Limited English Proficiency) population is 60%. That is significant to note, because it means that in each classroom, ESL strategies need to be in place. With the difficult science concepts that I will be teaching, I will need to use as many visuals as possible to effectively educate and engage this diverse population. I currently have 48 students that come to me with a range of skills, abilities, and background knowledge. As shown in the numbers above, half of the students that I teach come from homes where English is the primary language spoken. The other half, speak a language other than English at home. Over the past four years, I have noted that my ESL (English as a Second Language) students struggle with reading comprehension and using key vocabulary words appropriately. To help them understand the important science concepts that I'm teaching, I plan to do several demonstrations right off the bat that will grab their attention. Once I have their attention, we will add in key vocabulary and basic content knowledge to help them explain what they are seeing.

My goal for the students is that they come away with the science behind the magic. This unit is two weeks long and each week has a different focal point with several experiments to help the students beginto build a foundation for their science knowledge. The first week will focus on the difference between physical and chemical changes. The second week will explore the differences between acids and bases utilizing color indicators.

**Background**

My students will need the chemistry behind the experimental results to be explained in very easy to understand terms. For the activities that I have planned for the first week, I will make sure they understand and can distinguish between physical and chemical changes. A physical change is when substances change their appearance, but they are still the same substances we had at the beginning.For example, when an ice cube melts in our glass when we leave it in the sun, this is a physical change. It was water in the solid form and now it is water in the liquid form, but it is still water. When you drop a glass plate on the floor and it breaks into small pieces, the glass has only changed its form from that of a plate to that of scattered pieces, so this is another example of a physical change. A physical change would include evaporation, melting, cutting, breaking, or grinding. Describing a physical change in these terms will help my young learners.

A chemical change is quite different. When substances that make up one object have been changed into other substances, you have a chemical change. Rust on a car is a chemical change. What does that look like in an equation?

*The chemical equations for rust formation*

1. $2Fe(s) + 2H_2O(l) + O_2(g) \Rightarrow 2Fe^{2+}(aq) + 4OH^{-}(aq)$
2. $Fe^{2+}(aq) + 2OH^{-}(aq) \Rightarrow Fe(OH)_2(s)$
3. $4Fe(OH)_2(s) + O_2 + 2H_2O \Rightarrow 4Fe(OH)_3(s)$
4. $2Fe(OH)_3(s) + nH_2O \Rightarrow Fe_2O_3.nH_2O(s)$ or rust

The chemical formula for rust is $Fe_2O_3.nH_2O$

The **overall chemical equation** for the formation of rust is

Iron + water + oxygen => rust

$4\ Fe(s) + nH_2O(l) + 3\ O_2(g) \Rightarrow 2\ Fe_2O_3.nH_2O(s)$

This can be quite confusing for a first grader. Still, to explain chemical change, the teacher needs to understand the basic ideas behind the chemistry that is taking place so that you can help guide the students in their discoveries. Understanding the building blocks helps you to make sense of chemical change. Let's start with some basic vocabulary. A molecule is a set of atoms held together by chemical bonds. Atoms are the building blocks that make up matter. The atom is the smallest unit of matter that defines the element. A chemical reaction is any process that involves the transformation of one or more molecules into other molecules. A chemical reaction almost always involves the breaking and/or formation of new chemical bonds. (HCAB) We can write an equation to define a chemical reaction. The initial reactants are listed on the left side of the equation and the final products are listed on the right side of the equation. The Law of Conservation of matter states that matter cannot be created or destroyed. This is relevant to chemical reactions because it tells us that we must have just as many atoms of each element at the beginning of a reaction as we do at the end of a reaction.

Your body goes through chemical changes every day. When you chew your food you are making a physical change to the food. Once you swallow the food, enzymes break down the food so that our body can use it, which is a chemical change taking place.

Chemical reactions can be classified in four main ways:

**1.<u>Combination</u>**. A combination reaction is one in which two or more substances (the reactants) are combined directly to form a single product (the product). An example is the reaction in which sodium (Na) combines with chlorine ($Cl_2$) to form sodium chloride, or table salt (NaCl).

$2\ Na + Cl_2 \rightarrow 2\ NaCl$

**2. <u>Decomposition</u>**. A decomposition reaction can be considered to be the reverse of a combination reaction. In a decomposition reaction, one substance (the reactant) decomposes to form two or more products. For example, calcium carbonate (limestone) decomposes at high temperatures to calcium oxide (lime) and carbon dioxide. This reaction is used industrially to produce large quantities of lime.

3. **Displacement**. A displacement reaction (also called a single replacement reaction) occurs when an element reacts with a compound to form a new compound and release a different element. An example is the reaction that releases silicon (Si) from silicon dioxide (sand), $SiO_2$ , via its reaction with carbon. Carbon monoxide, CO, is the reaction's other product. When further purified, the silicon can be used in computer chips.

$SiO_2(s) + 2\ C(s) \rightarrow Si\ (s) + 2\ CO\ (g)$

4. **Exchange**. During an exchange reaction, "partners" in compounds on the reactant side exchange their partners to form two new products. One type of exchange reaction is called a neutralization reaction, the reaction between an acid and a base. The reaction of sodium hydroxide (lye), NaOH, with hydrochloric acid, HCl, to produce NaCl and water is such a reaction. In this case, $Na^+$exchanges its partner, $OH^-$for $Cl^-$ , and $H^+$ from $Cl^-$ to $OH^-$ .

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O\ (l)$

We will also be doing some experiments with polymers.  Polymers are large molecules, usually made up of repeating units.We will discover that polymers start out as tiny molecules called monomers.  Polymers are made up of many, many, monomersall strung together to form really long chains and sometimes more complicated structures too.

This information will be helpful as you go through the activities and start to describe the reactions that are taking place.  If you wanted to use these lessons with older students, you could have them start working with basic chemical equations.

In the second week, the students will need some background knowledge about acids and bases.  So what makes an acid an acid and a base a base? A chemist named Svante Arrhenius came up with a way to define acids and bases in 1887. He saw that when you put molecules into water, sometimes they break down and producean H+ (hydrogen) ion. At other times, you find the molecules produce an OH- (hydroxide) ion. When a hydrogen ion is released, the solution is said to be acidic. When a hydroxide ion is released, the solution is basic. Those two special ions determine whether you are looking at an acid or a base.

Some examples of acids are lemon juice and vinegar.  Acids release positively charged hydrogen atoms when they are dissolved in water and hydronium ions form.  Acid solutions can conduct electricity since they contain these ions.  A real-life example for the young students will be to show pictures of stalactites and stalagmites that form in caves. They are formed by carbonic acid dissolving the rock.

Bases also contain hydrogen, but they form hydroxide ions when dissolved in water. These ions can also conduct electricity. Chalk and cleaning solution are two examples of bases. To determine how acidic something is, a pH or potential of hydrogen scale is used. The scale ranges from 0 to 14. 0 means that that solution is extremely acidic and 14 means that the solution is extremely basic. It is important to know this information, because acids can damage metal and bases can't. If you were going to use a solution to wash your pots and pans with, you would want it to be basic.

This brief chemistry overview will help give students a framework when trying to uncover the magic behind the experiments.

The students also need to be familiar with the Scientific Method when conducting their own hands-on experiments. For the demos, I will just show them the substances I'm using and do the demo, without much explanation, to grab their attention. When they start to do their own experiments and start analyzing what they have done, they need to follow the steps of the Scientific Method to help explain their learning. The steps of the Scientific Method are as follows:

1. Ask a Question
2. Do Background Research
3. Construct a Hypothesis
4. Test Your Hypothesis by Doing an Experiment
5. Analyze Your Data and Draw a Conclusion
6. Communicate Your Results

With my first graders, we would start by having them brainstorm questions they have about the reactions we are about to do. We will predict (hypothesize) what we think might happen, test, and draw simple pictures or diagrams with labels to demonstrate and communicate what we have learned.

There is another key component of doing hands-on science activities with children, and that is safety. All of the students will need to have eye protection and a properly ventilated room when necessary. I will have the following lab rules in place when doing demonstrations and hands-on experiments.

1. Wear eye protection and tie long hair back when doing an experiment.
2. Never taste any substances that you are using unless the teacher directs you to do so.
3. Be aware of your surroundings and stay in your assigned lab area at all times.
4. Always listen to all instructions before starting a lab experiment.

5. Do not pour anything down the drain unless the teacher says it is okay.
6. If you spill anything, let your teacher know immediately. Do not try to clean it up yourself.

**Strategies**

SIOP – Sheltered Instruction Operation Protocol model

SIOP strategies will be used throughout this unit to support my second language learners. Due to the nature or the vocabulary involved in this scientific discovery unit, teachers that have learners with a native language other than English need effective strategies in place. As stated above, SIOP stands for Sheltered Instruction Operation Protocol and it was developed in an effort to make content comprehensible for (English Language Learners) or ELLs. It is also used to facilitate high quality instruction for English Language Learners in content area teaching. One can find the strategies used in hundreds of schools across the U.S. as well as in several other countries. According to Echevarria, Short, and Vogt, the developers of the SIOP model, there are five components that must be present in vocabulary instructions for ELL learners.[1]

1. The words must be intentionally selected and directly related to the topic being learned.

2. Direct instruction must take place.

3. Modeling must take place. Examples of how to use the word, as well as providing the students with visual representation of the word, aids in acquisition.

4. Multiple exposures to the word are necessary. The word or words cannot be used in an isolated situation and but used multiple times in various instances toengrained them in the memory.

5. There needs to be a system to track these new vocabulary words so that they can be reinforced and reviewed when necessary.

SIOP strategies are essential in this unit, especially when you consider the group of students that will be taking part in the activities. It is suggested that students have multiple exposures to newly introduced words. In fact, research done by the developers of the SIOP model, state that students need at least sixteen exposures to a word to commit it to memory.

Cooperative Learning Groups

Numbered Heads Together is a cooperative learning strategy that holds each student accountable for learning the material.[2] Students are placed in groups and each person is given a number (from one to the maximum number in each group). The teacher poses a question and students "put their heads together" to figure out the answer. The teacher calls out a specific number to identify the student who will respond as spokesperson for the group. By having students work together in a group, this strategy ensures that each member knows the answer to problems or questions asked by the teacher. Because no one knows which number will be called, all team members must be prepared. This strategy will be especially helpful after the demonstrations or hands-on demos have taken place. The students can use each other to help ensure that they understood what they saw taking place. This takes the pressure off of a student who may not yet have an understanding of the needed vocabulary.

Inquiry Journals

Inquiry journals will be used to track the questions that we have, will have drawings and label pictures drawn after our experiments, and be a place to describe or draw new science concepts that have been learned. As the teacher, I will use these journals to determine if the students understand the concepts presented. This can help me identify misconceptions that the students have and can help me identify students that are ready for more advanced vocabulary.

Demonstrations

I will be using demonstrations to introduce some challenging concepts to the students. If I started with a vocabulary lesson, I might lose some of their interest. If I start off with an awesome chemical reaction demonstration and then ask them if they want to figure out how it was done, I will have higher student engagement.

Hands-on Experiments

The students will be participating in several hands-on activities. The purpose of these is to help them explore a concept through manipulation of the materials. They can have a better grasp of the scientific concepts behind the experiment when they are the ones physically doing it. This allows them to find answers to their questions through exploration, and is also very motivating for the students.They get excited about getting to do a science experiment, and this excitement leads to a deeper understanding of what is taking place.

Foldables

Foldables are 3-D paper constructions that allow learners to record and process new words and concepts in a hands-on, kinesthetic way. Learners retain more concepts due to the process of creation and manipulation. These can be used in a variety of ways. One usage is to determine examples and non-examples of key vocabulary words. They can also be used to strengthen comprehension skills. A foldable could have two sections labeled acids and bases. The students could demonstrate their understanding of what acids and bases are after learning about them by completing each section of the Foldable.

KWL Chart[3]

These charts are graphic organizers that help identify the information that students already know as well as the questions that they have about a topic. It provides scaffolding for the students and prepares them for new content that is being taught. At the end of a lesson the students list what they learned. Thisexercise is a time when the questions can be revisited and concepts can be reviewed. Before an experiment we would write what we know about the substances being used and track any questions that we have about the experiment. After conducting the experiment we would add what we learned to the chart.

**Activities**:

Day 1 - Powering up the Magic Wand

**Book** - Cinderella - focus will be on the Fairy Godmother and the way she uses magic to solve Cinderella's problem

**Experiment –** Saltwater Circuit

The students will see me place the lightbulb into water; plug it in, turn it on and nothing happens. When I use my magic wand (and sprinkle salt into the water), I am able to get the lightbulb to light.

**The Mystery Behind the Magic**–An ion is an atom that has an electrical charge, either positive or negative. Salt molecules are made of sodium and chloride ions. When salt enters water, the water causes the salt's sodium and chloride atoms to pull apart and the salt crystals begin to disappear. As a result, a sodium ion and a chlorine ion are now floating in the water. The sodium ion is missing an electron, which gives it a positive charge, and the chlorine ion has an extra electron, which gives it a negative charge.

When an electric potential is applied, the positively-charged sodium ions are attracted to the negative pole and the negatively-charged chlorine ions are attracted to the positive pole. These ions carry the electricity through water. The essence of the above process is that an "invisible wire" is formed that allows electrons to move from ion to ion across the water.

Day 2 - Secret Messages

**Book** - The Secret Birthday Message by Eric Carle

**Experiment** - Disappearing Ink

**Materials:**Measuring spoons ( 1/2 teaspoon and teaspoon), Zip-closing bag (snack size), Water, Clear gel glue, Food coloring, Measuring cup (1/4 cup), Marking pen, Disposable plastic cup (3 oz.), Disposable plastic spoon, Borax, Glitter, Metric ruler

1. Pour 2 teaspoons of water and 1 teaspoon of clear gel glue into a zip-closing bag.
2. Seal the bag completely. Squeeze the bag between your fingers until the contents are thoroughly mixed.
3. Open the bag and add two drops of food coloring.
4. Repeat step 2.
5. Use the marking pen to label the cup “borax solution”.
6. Pour 1/4 cup of water into the plastic cup.
7. Make a borax solution by adding 1/2 teaspoon of borax to the water in the cup and stirring with the plastic spoon until most of the borax dissolves.
8. Open the zip-closing bag and add 1 teaspoon of the borax solution to the glue mixture.
9. Repeat step 2.

**The Mystery Behind the Magic** - The glue and water mixture contains long chains of a polymer called polyvinyl acetate. When you add the borax solution, it links the long monomer chains together, changing the liquid into a slimy glob. When you add the glitter to the slime, it stays there and does not easily come back out.

The slime is like mucus that we find in our bodies. Our natural mucus contains sugars and proteins, which are also polymers. Mucus protects many other parts of your body. The inside of your stomach is completely coated with it. If there were no mucus to protect your stomach, the powerful acids used to digest your food would digest your stomach too.

Day 3 - Lift Off!

**Book** - Rocket Town by Bob Logan

**Experiment** - Pop Rockets

**Materials** - 2 Alka-seltzer tablets, film canister with snap-on lid, safety glasses, timer

**Procedure:**
1. Divide Alka-seltzer tablet into four pieces
2. Fill the film canister 1/2 of the way full with water
3. Get ready to time the reaction of Alka-seltzer and water.  Place one tablet in the canister.  What happens?

4. Time the reaction and write it down. How long did the liquid keep bubbling? Why do you think it stopped?
5. Repeat the experiment. This time, place the lid on the film canister right after you drop in the Alka-seltzer tablet. If you are lucky, the top will fly off.
6. With the remaining Alka-seltzer pieces, decide how many you want to put in the canister at a time. Will the amount that you put in make a difference?

**The Mystery Behind the Magic** - The alka-seltzer table reacts with water to create carbon dioxide gas. You can see this when it bubbles. Carbon dioxide gas builds up to high enoughpressure inside the closed film canister to overcome the pressure of the atmosphereand thenthe lid pops off.

Day 4 - A Real Diaper "Genie"

**Book** - Pirates Don't Change Diapers by David Shannon

**Experiment** - The Baby Diaper Secret

**Materials** - Disposable diapers, zip-lock bags, scissors, newspaper, water

**Procedure:**
1. Place a new diaper on the center of the newspaper. Carefully cut through the inside lining and remove all of the cotton-like material. Put the stuffing in a zip-lock bag.
2. Scoop up any of the polymer powder that may have spilled onto the paper and pour it in the bag with the stuffing. Blow a little air into the bag to make it puff up like a pillow and then seal the bag.
3. Shake the bag for a few minutes to remove the powdery polymer from the stuffing.
4. Carefully cut off the corner of the zip-lock bag so that you have a little pocket of polymer.
5. Pour the polymer into a plastic cup and fill the cup with water. Mix it with your finger until the mixture starts to thicken.
6. Observe the gel that the polymer and the water have created. Turn the cup upside-down and see how it entirely solidified.

**The Mystery Behind the Magic** - The absorbent material in a diaper is a super-absorbent polymer called sodium polyacrylate. Super-absorbent polymers expand tremendously when they come in contact with water because water molecules are drawn into them and held by the molecules of the polymer. They act like giant sponges. Some can soak up to 800 times their weight in water!

Day 5 - Let it Snow!

**Book** - Snowmen at Night by Carolyn Buechner

**Experiment** - Making Snow

**Materials** - Insta-Snow® polymer, 2 plastic cups, Measuring cups, Blue measuring scoop (1 teaspoon), Water

Procedure- Follow directions on the Insta-Snow® package

**The Mystery Behind the Magic** - Insta-Snow® is actually derived from the superabsorbent polymer found in baby diapers. The only difference (and it's a big one) is that the Insta-Snow® polymer not only absorbs water but the long chains of molecules swell to an enormous size. The polymer soaks up water using the process of osmosis (water molecules pass through a barrier from one side to the other). When water comes in contact with the polymer, it moves from outside the polymer to the inside and causes it to swell. The polymer chains have an elastic quality, but they can stretch only so far and hold just so much water.

The Insta-Snow reaction is a great example of a physical reaction - a reaction where the substance itself does not change. When an ice cube melts, a physical reaction takes place where the solid ice turns into a liquid, but the substance (water) never changes –its still water! However, in a chemical reaction, a new substance is formed and energy is either given off or absorbed.

Day 6 –Brush Up!

**Book** - <u>Elephants Cannot Dance</u> By Mo Willems

**Experiment** - Elephant Toothpaste

**Materials** - 16 oz empty plastic soda bottle (preferably with a narrow neck such as those made by Coca-Cola), 1/2 cup 20-volume hydrogen peroxide (20-volume is 6% solution, purchased from a beauty supply store), Squirt of Dawn dish detergent, 3-4 drops of food coloring, 1 teaspoon yeast dissolved in approximately 2 tablespoons very warm water, Funnel, Foil cake pan with 2-inch sides, Safety glasses, Lab smock

**Procedure**:

1.Have students put on their safety glasses and lab smock.  Each student should have in front of them a cake pan, plastic bottle, Dawn in small cup, food coloring, 1/2 cup peroxide, and the dissolved yeast mixture.
2. Stand the bottle up in the center of the cake pan. Put the funnel in the opening. Add 3-4 drops of food coloring to the peroxide and pour the peroxide through the funnel into the bottle. Show a water molecule diagram and a peroxide molecule diagram, pointing to the extra oxygen that will be set free in the reaction.
3. Add the Dawn detergent to the peroxide in the bottle.

4. Pour the yeast mixture into the bottle and quickly remove the funnel.
5. The students can touch the bottle to feel any changes that take place.

**Mystery Behind the Magic**: Hydrogen peroxide ($H_2O_2$) is a reactive molecule that readily decomposes into water ($H_2O$) and oxygen: $2H_2O_2 \rightarrow 2H_2O + O_2(g)$ In this demonstration, yeast catalyzes the decomposition so that it proceeds much more rapidly than normal. The dishwashing detergent captures the oxygen that is released, making foam. Food coloring can color the film of the bubbles so that you get colored foam. In addition to being a nice example of a decomposition reaction and a catalyzed reaction, the elephant toothpaste demo is exothermic, so heat is produced.

Day 7 - Colorful Chemistry

**Book** - Rainbow Fish by Leo Lionni

**Experiment** - Acids and Bases

**Materials** - red cabbage, filter paper or coffee filters, boiling water, pot, strainer, lemon juice, white distilled vinegar, water, baking soda, washing soda (or ammonia)

**Procedure:**

1. Dice 1/2-3/4 of a cabbage into small pieces and enjoy the beautiful color.
2. Boil water in the microwave or on the stove.
3. Pour boiling water over the cut cabbage and allow to steep until room temperature.
4. Strain cabbage through a strainer so only the purple liquid remains. You may chose to filter the cabbage/water solution through a coffee filter in addition to straining.
5. Reserve the purple liquid for experimentation. I store my excess cabbage juice in an empty plastic peanut butter container with a tight lid.
6. Pour the cooled cabbage indicator solution into test tubes or small jars. Do a baseline comparison, which should look like the chart below.

Here is what our baseline comparison tests look like:

- Lemon Juice = pink
- Vinegar = red
- Water = no change, purple
- Baking soda = blue
- Washing soda = green
- Bleach or drain cleaner = yellow/white

Once the baseline jars are set up, you can test any of the following items:

- cream of tartar, ammonia, antacids, soapy water, salty water, rain, oven cleaner, cleaning solutions, soda (pops) clear is better, oranges/orange juice

Test your items and determine whether they are an acid or a base.

Day 8 - Up, Up, and Away!

**Book** - Where do Balloons Go? An Uplifting Mystery by Jamie Lee Curtis

**Experiment** - Balloon Blow-Up

**Materials** - A bottle with a narrow neck, vinegar, baking soda, funnel or straw, water, balloon

1. Pour about an inch of liquid--half vinegar, half water--into the bottle.
2. Use the funnel to fill the balloon half full of baking soda.
3. Stretch the open end of the balloon over the neck of the bottle. Make sure it's on tight! Let the heavy end of the balloon dangle, so no baking soda goes in the bottle.
4. Hold onto the balloon at the bottle neck, and pick up the heavy part of the balloon so that all the baking soda falls into the vinegar at the bottom of the bottle.

**The Mystery Behind the Magic** :The baking soda/vinegar balloons is a fascinating demonstration of acid base chemistry. Vinegar is water with about 3 percent of a chemical called acetic acid. Baking Soda is a compound called sodium bicarbonate, also known as sodium hydrogen carbonate ($NaHCO_3$), and is a base. So the reaction occurs:

Aceticacid + sodium hydrogen carbonate --->water and $CO_2$ and sodium acetate (or more specifically, aqueous sodium ions and aqueous acetate ions; evaporate the water away and you should get sodium acetate, a salt -- sodium acetate is used to de-ice airport runways. It has the property that dry sodium acetate emits heat when it dissolves in water).

$CO_2$ (carbon dioxide) is the gas that's produced and that expands the balloon. The trick of the project is to get enough $CO_2$ produced and to make the seal between the container you're mixing the baking soda and vinegar sealed well enough so the $CO_2$ doesn't leak out. It takes some pressure to inflate a balloon, so some $CO_2$ may escape if the seal isn't tight. Carbon dioxide is heavier than air, the balloon won't float in the air, but will fall to the ground and stay whatever it's placed.

## Conclusion

I hope that through this unit your students will start to build a strong foundation for the basics of chemistry.  You can use this unit in its entirety, or select experiments that correlate to what you are teaching.  Remember that science is fun!  You can always go deeper into certain concepts with your higher ability students and work with the basics for your students that need more support.  This unit connects great children's books to science experiments so that you can cover multiple objectives in one session!  The magic wand is yours – Enjoy!

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This book contains excellent science experiments and fun science facts for students. It has experiment ideas for all areas of science exploration.

Spangler, Steve .*Secret Science: 25 Science Experiments Your Teacher Doesn't Know About*. Sandy, Utah: Silverleaf Press, 2007.
In this science book, written for kids, you will find experiments that you can do at home with common household materials. The science concepts behind the experiments are easily explained.

Stewart, Ian, and Justin Lomont.*The Handy Chemistry Answer Book*. Canton, MI: Visible Ink Press, 2014.
This guide for older students answers the questions that budding chemists might have. It covers all areas of chemistry and organic chemistry in easy to understand terms.

Stovall, Iris, Donald J. DeCoste, and Steven S. Zumdahl.*Study guide, Introductory chemistry, a foundation ; Introductory chemistry ; Basic chemistry :: fourth edition, Steven S. Zumdahl*. fourth edition ed. Boston: Houghton Mifflin, 2000.
This college chemistry book helps students in the early chemistry classes understand the basics that they need in order to succeed in future courses.

VanCleave, Janice Pratt. *Chemistry for Every Kid: 101 easy experiments that really work*. New York: Wiley, 1989.
This book contains easy-to-do experiments for kids. The materials are easy to find in local stores and they help students develop a strong science foundation.

## Annotated Bibliography for Students

Buehner, Caralyn, and Mark Buehner.*Snowmen at Night*. New York: Phyllis Fogelman Books, 2002.
This children’s fiction book is about what snowmen do when we are asleep. They go all over town and this is why they sometimes look different the next day!

Carle, Eric. *The Secret Birthday Message*. New York: Crowell, 1972.
This fiction story is about Tim. It is Tim's birthday. Instead of a package, Tim gets amysterious letter — written in code!

Disney, Walt. *Cinderella*. New York, NY: Gallery Books, 1986.
This classic fairy tale tells of a young girl who is blessed with a Fairy Godmother who makes all of her dreams come true.

Logan, Bob. *Rocket Town*. Naperville, IL: Sourcebooks Jabberwocky, 2011.
The story follows an astronaut and his canine companion as they drive an old pickup through Rocket Town, passing all manner of space craft like a taxi rocket, a police rocket, a school bus rocket, and even a rocket that looks like a shark.

Long, Melinda, and David Shannon.*Pirates Don't Change Diapers*. Orlando, Fla.: Harcourt, 2007.
This fiction books tells the tale of a boy who runs away with pirates, only to find out that they are not as caring and helpful as his mother.

Seuss, Dr. .*Bartholomew and the Oobleck*. New York: Random House, 1949.
In this fiction story the King wants something new to fall from the sky. He gets quite a surprise when he discovers that Oobleck is much different from the types of precipitation that he is used to!

Willems, Mo..*Elephants Cannot Dance!*. New York: Hyperion Books for Children, 2009.
This fiction book tells of an elephants struggle as he learns to dance!

Notes

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[1]Echevarria, Jana, Deborah J. Short, and Maryellen Vogt. *Making Content Comprehensible for English Learners: The SIOP Model*. Boston: Allyn&Amp, 2007, 111.
[2]Echevarria, Jana, Deborah J. Short, and Maryellen Vogt. *Making Content Comprehensible for English Learners: The SIOP Model*. Boston: Allyn&Amp, 2007, 85.
[3]VanCleave, Janice Pratt. *Chemistry for Every Kid: 101 easy experiments that really work*. New York: Wiley, 1989, 15.

## Appendix 1 - Implementing Common Core Standards

This unit relies on making connections to children's literature. It covers a variety of literature standards for first grade.

CCSS.ELA-Literacy.RL.1.9 Compare and contrast the adventures and experiences of characters in stories.

In this unit, the students will listen to a variety of fictional stories and compare the experiences of the characters to the experiences that they are having during the science portion of their unit.

CCSS.ELA-Literacy.RL.1.7 Use illustrations and details in a story to describe its characters, setting, or events.

In this unit, students will need to identify important story elements in order to connect them to what we are learning during the science experiment. The students will need to be able to describe what is happening to the characters in the story so that they can determine if they are feeling the same feelings during the experiment.

1.P.1 - Understand how forces (pushes or pulls) affect the motion of an object.

In this unit, force and motion are a part of several of the experiments. The students need to understand what force is and they need to know that force can be a push or a pull. It can also affect the direction that an object travels. This information is important so that the students can explain the "mystery behind the magic".

1.E.2 - Understand the physical properties of Earth materials that make them useful in different ways.

In this unit, several experiments are going to be conducted. Often times a physical or chemical change is going to take place. Students need to understand what physical properties are so that they can determine if a change has taken place or not.

2.P.2 - Understand properties of solids and liquids and the changes they undergo.

In this unit, some of the experiments involve changes in matter. Students need to understand what solids, liquids, and gases are for several reasons. They need to understand what they are working with for each experiment.