Magical Mysteries of Chemistry

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This curriculum unit is recommended for:
NC 8th grade integrated science, Core standards 8.P.1.1, 8.P.1.3, 8.P.1.4

Keywords: Physical properties, Chemical properties, Chemical reaction, Exothermic, Endothermic, Law of Conservation of Mass/Matter

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit. (Insert a hyperlink to Appendix 1 where you've stated your unit's main standards.)

Synopsis: This unit will focus on the 8th grade general science chemistry unit. The purpose of this unit is to grasp my students' attention and make them eager science learners. Sir William Lawrence Briggs said, "The important thing in science is not so much to obtain new facts as to discover new ways of thinking about things." Technology has changed education and how we educate must change with it. The understanding of the basics of chemistry at the 8th grade level is critical for students who will take higher level chemistry courses. The unit will enable students to Classify matter as elements, compounds or mixtures. To compare physical changes such as size, shape and state to chemical changes that are a result of chemical reactions that include changes in temperature, color, formation of gas or precipitate, and to explain how the idea of atoms and a balanced chemical equation support the law of conservation of mass. This unit helps put science within the actual grasp of all students.

I plan to teach this unit during the 2013 school year to approx. 180 students in 8th grade general science classes.

Magical Mysteries of Chemistry

Nancy Kuzniar

Introduction

This unit will focus on the 8th grade general science chemistry unit. The purpose of this unit is to grasp my student's attention in every class. I want to make them eager science learners. My wish is for them to become individuals that can make connections from any existing previous knowledge and the content to their everyday life and the world around them. I want my students to see how the lesson learned is a part of everyday life and the possibilities that the knowledge can have effects on the future. I believe as Sir William Lawrence Braggs did when he said, "The important thing in science is not so much to obtain new facts as to discover new ways of thinking about things".

Technology has changed education by adding games, videos, music and research at most students' finger tips. The North Carolina Standard course of study requires educators to incorporate technology into our science classes. The state also adopted a policy to bring the infusion of "21st century skills," which is designed to produce globally competitive students, by learning skills that are essential for success in today's world such as critical thinking, problem solving, and use of technology, communication, and collaboration skills.(1) These skills are learned best in interdisciplinary activities.

The essential standards and objectives for this part of the curriculum are: 1. Classify matter as elements, compounds or mixtures 2. Explain how the physical properties of elements and their reactivity have been used to produce the current model of the periodic table 3. Compare physical changes such as size, shape and state to chemical changes that area result of chemical reactions that include changes in temperature, color, formation of gas or precipitate, and 4. Explain how the idea of atoms and a balanced chemical equation support the law of conservation of mass. (2)

I want to put science within the actual grasp of all my students. That being said, science supplies, especially chemicals, are not easy to acquire stock and/or fund at our middle school. So, my goal is to secure all the materials I need at my local grocery store and/or pharmacy, while still making the chemistry unit interesting and exciting.

Background

The school, in which I teach general science, is a middle school, grades six through eight. We currently have a total population of 1151 students of which 603 are male and 547 are female. Because of the schools location within our school system, the population is very diverse. Our students come from a wide range of socioeconomic backgrounds as well as ethnicities. 54% of our students are white, 25% are black, and 11% are Hispanic and 10% other. We have students that live in multi-million dollar neighborhoods and well as 22 that are homeless or in transition. This includes students living in shelters, extended stay motels, or with extended family members. 340 of our students receive free lunch and another 76 receive reduced price lunches.

My current assignment is that of 8th grade general Science teacher. I currently have 182 students, which I see only every other day according to an A day, B day block schedule. Our school does not separate science classes based on abilities. My classes are all mixed levels. All my classes contain students that are classified as academically gifted, English as a second language (ESL), and students with learning disabilities. My smallest class contains 29 students and my largest class contains 36. Many of my students are on grade level, some are above grade level and some are below grade level, some having reading and math abilities as low as the first grade level. We also have our share of students with behavior disorders or issues that can present various issues while performing labs in a classroom setting.

Chemistry Background and Vocabulary

Science terms and language can often seem like a foreign language to an 8th grade student. It is essential to provide basic vocabulary for a better understanding of the concepts. To accomplish this, prior to teaching each main idea, I give notes to the students, we read together and/or on their own, they share thoughts and ideas with each other following the reading of certain sections of the lesson, and they write a definition in their own words using three to five sentences providing a picture for each vocabulary word. They are fully expected to master a list of terms. Vocabulary quizzes and activities are given as warm ups to help ensure the vocabulary is adequately understood. Writing three to five sentences is good practice that helps with interpretation and goes along the lines of common core using writing strategies. These practices will also help my ESL students in understanding the vocabulary because the pictures serve as a visual aid. It is said, "A picture paints a thousand words"; I believe if you can picture a concept, you can understand it.

Prior to the discussion of the activities, I determined my students' prior knowledge of atoms and molecules as well as phases of matter. We discuss that the phase of matter depends on the amount of energy in the matter and that all forms of matter are made of particles that move, and that movement is linked to the amount of energy they possess.

Magic, Mystery and 8th grade Chemistry

The first 8 weeks of the first semester focuses on the study of matter. This includes classifying matter and differentiating between elements, compounds and mixtures, comparing physical changes to chemical changes, understanding the properties of matter and the changes that can occur when matter interacts, the structure of an atom, the organization of the periodic table, and ultimately the idea that atoms and a balanced chemical equation support the law of conservation of mass.

Chemistry is all around us, and it is part of everything we do every day of our lives. It can be as simple as the material in the clothes we wear and the salt we put on our food, to as wondrous as what will be the next level of warfare and what will fuel our tomorrows. But it is not what my students learn as far as the body of knowledge they have, but rather how they begin to think.

Matter is anything we can see or touch. It is anything that has mass and volume. Matter exists in most cases as a solid, liquid or a gas. Elements are the purest thing we can break matter down to. Elements are pure; they cannot be broken down into simpler substances. They are all around us, and we see and use them every day. They are the gold on our fingers or in our ears, the aluminum foil we wrap our left-overs in, and the iron nails that hold our houses together. They are composed of one type of atom. Compounds are also pure substances but they are composed of two or more types of elements that are chemically combined, so they can only be broken down by chemical changes. Compounds are everywhere from the water we drink, to the coins we use for money, even the sugar we put on our cereal. Mixtures are also composed of two or more substances, but the substances retain their own properties and are combined physically (mixing). Mixtures can be heterogeneous, like the rocks and sand on the beaches we visit, to the various veggies in the salad we have for lunch. Mixtures can also be homogeneous like the coffee we drink with milk and sugar to the alloys we use to pay for the very cup of coffee.

Students come into chemistry with a pretty good idea of what mixtures are. Students learn with understanding and actively building new knowledge from experiences and prior knowledge. (3) I start off the topic, and to tap into knowledge they already have, I ask them to come up with examples from their lives from that very day. When we do this exercise, I have them looking at their vocabulary for mixtures, compounds, homogeneous mixture, and heterogeneous mixture.

In order to understand the difference in the types of combinations of elements my first class of the unit starts with a warm up. I first show my students several examples of each type of mixture, simply using objects in the room. I have the student watch a short Discovery Education Video, “What is a mixture”. Then I have them break out into predetermined groups (determined by Math and Language Arts MAPS Scores). The groups have to discuss mixtures and come up with five examples of each type of mixture. After reviewing and discussing the correctness of our examples, we watch the Discovery Education Video clip, “Heterogeneous and Homogeneous Mixtures”, and on YouTube:

ScienceMan Digital lessons-Mixtures Homogeneous/heterogeneous.(4) When I determine the group has sufficient understanding of these concepts, it is time to get them up and moving. I want to get my students up and active, excited and working together to solve a problem.

Studies show perceptual preferences affect more than 70% of school individuals. So my various lessons are designed to hold multiple learning style components. There are three basic learning types: visual, auditory and kinesthic (tactile). In the Kolbs experiment model they us these styles, The Honey Mumford model modified it, and added to the concept the importance of having an experience.(5)

Chemistry is a bit of a mystery to 8th graders so experience is most important. If my students can't actually experience something than, I will insure that they at least imagine it. Following the initial exercises, we review what we have accomplished and make conclusions with our new found knowledge. This activity not only appeals to my kinestic learner, but also to the middle school students' natural sense of competition. "Competition can be good for children. I can help children develop healthy attitudes about winning and losing. Children become competitive as they refine and practice skills and develop cognative abilities. Competition can encourage growth and push a child to excel."(6) I see competition in my classroom as a useful tool. It works to develop confidence, develop skills, improve problem solving abilities, learn rules and the importance of following them, and aids in the important skill of cooperation in groups.

I call the activity a challenge. The prize to the team that solves the problem in the shortest amount of time and with the most success, is a heterogeneous mixture, a pizza. The students are placed in groups of five, based on achievement levels and previous class performance.

Separation Challenge

Equipment

- 1 - 250 ml beaker
- 50 ml of sand
- 50 ml of dried parsley
- 50 ml of sugar
- 2 – tooth picks
- 1 – pair of tweezers

The sand, Parsley and sugar is premixed and contained in a single beaker. The students are advised that they can use almost anything available to them in the room, as long as they gain permission from me. I have other objects purposely placed around the room such as, more glass ware, sinks with water, paper towels, coffee filters etc... Going into the lab, students are given a work sheet (Appendix 2) that has the definitions of both heterogeneous and homogeneous mixtures on it, with examples of each. They are given the following instructions, "This is a challenge that will be timed. Your group's task is to separate out the sugar, sand and parsley. You will have completed this task when the group can show me the three separate items contained in three separate containers."

Here is what typically may happen. I take out my stop watch once the groups are in place (not so patiently awaiting the signal!). I press the watch as I yell go! The groups start working frantically, after all it is a competition and 8^{th} graders take that seriously. They easily realize that they have been given a heterogeneous mixture. I walk around from group to group, initially some groups are talking about what to do first and others just dive in. Some groups, because they have been given tooth picks and tweezers, are positive that using them is the solution and they pour out the mixture and physically take it apart, using these rather primitive tools, piece by arduous piece. Using the tweezers they first begin pulling out the pieces of parsley. Realizing this is going to take a lot of time, other members of the group join in picking out parsley with their fingers. If picking out the pieces of parsley is not frustrating enough they then get to separate the sugar from the sand. Some groups ask for magnifying glasses to make seeing the difference easier, I gladly supply them with this tool. Soon, this just becomes too much for them. They are growing tired and bored. For those groups, I begin to leak out a bit of information. I let them know they would be here for hours if not days doing it that way.

They begin again, to talk it out. After what is normally a short time, (in most cases less than 5 minutes) the groups' progress and one will ask if they can use water. Following the one group asking to do this, the rest soon follow. The groups are now moving feverishly around the room looking for any type of strainers or spoons. No strainers of any type are visible in the room. Some try to make homemade filters using pins to poke tiny hole in paper towels or asking for the coffee filters. Ultimately the process that works the quickest and the best is to add water to the original beaker still containing all three substances. The moment water is added the sand being the heaviest and most dense sinks directly to the bottom. Gently swirling the solution or mixing it with a small spoon dissolves the sugar, and because it is dry and has more surface area, the parsley floats on the surface. Separating the three into different containers is now easy. The parsley is skimmed off the top using a spoon or even fingers. Following that, the water is poured into another beaker, thus separating the sugar which is now in a sugar water solution. At this point, all that is left in the original beaker is the sand.

The students all must provide a write up following this challenge. The write up is great practice in writing lab procedures. They are told to use skills they had learned using the scientific method. They need to write a procedure precise enough for someone else to duplicate their solution elsewhere. They also are asked to come up with a way to get the sugar back without the water. Possible solutions would be evaporation and/ or boiling the water. At the end of the experience I show the students some methods of filtering and straining. The class ends with a discussion on where and why these skills may come in handy in the real world.

The ultimate goal of the 8th grade chemistry unit is for the students to gain the basic understanding of Antoine Lavoisier's law of conservation of mass. They need to see through chemical reactions/equations, that matter cannot be created or destroyed. To accomplish this, we have to start with the differences between physical and chemical characteristic properties of matter. The next few activities help students with these concepts.

Kuzniar's Don't Show and Don't Tell

The students need to recognize that physical properties can be seen and observed without having to resort to elaborate chemical testing and changing of the substance. This can be very confusing to the eighth grade mind. So in this lesson I use an activity that addresses all the learning modalities.

I have and old cardboard box that is approximately one foot square. The box has a removable lid with a hole, large enough for anyone's hand, cut in the top of it. Contained in the box are five or six common items that all of my students are familiar with. The outside of the box is decorated like the circus is coming to town. Just the decorations initially get the students curiosity going. They start out excited to be doing an activity that they will all participate in. The simplicity of this activity is its' beauty. I take the box to the front of the room and place it behind a room divider. I ask for a student volunteer, there are usually many. The volunteer comes up to the front of the room goes behind the divider, where I advise them to reach into the box. The volunteer reaches in the box and pulls out an object. The volunteer is the only one that can see or feel the object, therefore the "No Show." The volunteer then proceeds to describe the object to the class. The description is the physical properties of this piece of matter. They do not even know they are giving physical properties but, all of them automatically rattle off the basics like shape, size, and color. After they mention two or three properties, the audience or other students start to participate by guessing what the object might be. As the volunteer starts to run out of descriptive ideas, the audience starts to ask questions about the object. They ask about texture, luster, malleability, ductility sometimes even its boiling point or melting point. They are also describing the physical properties. A good example of an object I might use is a golf ball. All the students are actively engaged trying to visualize the object, listening to the descriptions and the questions and guessing what the object is. After repeating this game four or five times the class is directed to complete the normal vocabulary exercise we do for the terms physical and chemical properties. The students soon realize, as they are writing the definitions for physical property, this is what the game was all about.

H2O is H2O is H2O

A demonstration of physical versus chemical change along with follow up questions enables me to evaluate the level of understanding. Students enter the room and the warm up prompt is written on the promethean screen. It simply says, “Use your notes from the previous class to describe what you see.” The students sit down, prepare for class, and read the prompt; many hands go up in the air. Some students just blurt out, “describe what?” The only thing on the lab table in the front of the room is a glass of ice water, ice water that I drank and all that’s left in the glass is the ice. I ask them to write a description of the cup. When all have completed that task, I pour the ice in a beaker and plug in a hot plate. As soon as I put the beaker on the hot plate the ice begins to melt. I point out the ice is H_2O, and that melting point is a physical, property of H_2O, as is the phase. I continue to let the H_2O heat up and it turns into a liquid and I point out it has changed phase but liquid water is still H_2O. Soon the water is boiling. I point out that at the boiling point liquid turns into a vapor and that boiling point is also a physical characteristic. The liquid H_2O is turning into water vapor and the vapor is still H_2O. I add a bit of salt to the boiling water and it stops boiling. Some of the students argue that I changed the boiling point of H_2O. I explain that it is not just H_2O, but a saltwater solution. We discuss why phase change is a physical property. I explain that it is not a chemical change and discuss that if the water is allowed to evaporate the salt will be left behind.

Gilligan’s Island

Continuing with today’s theme of H_20, I tell my students that we are going on a journey. I tell them they must close their eyes to imagine they are going on a three hour cruise with four of their classmates. They are separated into five student groups and the pretending begins. I ask them to picture themselves on the coast of Florida; they are getting set to board a small yet beautiful boat. Upon boarding the boat they notice a survival kit. The kit contains an ax, a bic lighter, a small pot, a medium pot, a large pot, fishing twine and hooks. As the cruise continues the weather starts getting rough and the tiny ship is being tossed. If not for the talent of the fearless crew the boat would be lost. I even amuse them by playing the theme to the television show, Gilligan’s Island. They are instructed that their pleasant cruise has resulted in a ship wreck on a deserted island. There is beautiful crystal blue seawater all around them that is loaded with fish. The sky above is cloudless and shore birds fill the air. The island has no mammal inhabitants, there are many insects, and in fact the trees are full of them. I tell them that they were knocked unconscious while getting thrown from the boat, you wake up to find… I want them to write me a short story of where they are and how they will feed themselves and get fresh water.

This exercise is an interesting cross curriculum activity to give the students a chance to work in cooperative groups where they must stop, think and get creative. As they start to work on their ideas, the question of whether you can drink saltwater is raised. I explain that they cannot and it is getting very hot and sunny, dehydration is going to take its toll if they do not drink something; they realize freshwater needs to be one of their first priorities. Many of the stories that have come from this activity are very amusing; some groups have even turned this activity into short plays. The solution is to boil the water in the small pot, capture the condensation in the medium pot, and let it drip into the large pot. The water that is captured is fresh and they live on.

Making paper disappear

Chemical properties are not as easy to understand. I do not go over all of them with my 8^{th} graders, but I do want them to be aware of the properties of flammability, ability to rust or oxidize, acidity, and combustibility. These terms will be used later when they are asked to recognize whether a physical or chemical reaction has taken place. My basic definition for chemical properties is the identification of properties that determine how a substance reacts and changes into other substances.

When all students seem confident with the understanding of physical change we move on to chemical change. The next class starts with a series of several demonstration/observations. I take a piece of printer paper and rip it in half. I question, "Is it still paper." Starting with such an easy question gets everyone in the class participating with verbal responses. I tear the paper again, and again, and again. Every time asking if it is paper and getting the majority of the class to respond. I have just reviewed physical change. I changed the shape and size, but the paper remained to be paper. I light a blow torch. Why not just a match or small lighter, because the sound of a powerful blow torch holds the attention of just about every one of my young semi-pyrotechnical eight graders. I hold a small piece of paper in my hand and light it. I let it burn almost completely down to my fingers, and just before they burn, I drop it on to a plate. It cools very quickly and I dump the now gray-ashed paper into my hands. I rub them together quickly and walah, it disappears. "Why?" I ask through the roaring sounds of oooo's and ah's. I answer; it is because there was a chemical reaction.

I ask, "How we know that there was a chemical reaction?" The first answer comes quickly; it is obvious as they inform me of the color change. I ask the students, in their notes, to describe the color change viewed. Most briefly they usually write that it turned from white to gray and black. I question, is it still paper? Their response is an overwhelming, no. So, this means it is not the same substance it once was. The original substance has changed into something new, and this leads me into a series of notes about how to recognize if a chemical reaction has taken place. I let them know that some chemical changes are easy to see, and I compare it to baking a cake. The ingredients are the reactants, sugar, eggs, milk, flour, the oven and cooking is the chemical reaction and the product is the cake. That example would be a chemical reaction that is easy to see because the product looks nothing like the reactants. Some changes are not so apparent. There are four basic things to look for: Color change: an example would be rust, Formation of a precipitate: an example of this is how some shellfish form their shells, the formation of a gas: example is an Alka Seltzer tablet dissolving in water (I show them this one for my visual learners), and temperature change: an example of this is an instant ice pack in first aid kits (we break the seal on a small one of these and pass it around).

This is the point at which I first introduce the law of conservation of mass/matter. I describe the law simply as mass cannot be created or destroyed, and that even though matter cannot be created or destroyed, in chemical changes the particles are just rearranged to form new substances. The same number of particles that existed before the change exists after the change! I again talk about the cake, and that example makes sense to them but then I give them one to really ponder, what about the paper burning? None of them agree that nothing was destroyed. This is a difficult concept for them to grasp, after all they just saw the paper disappear. This is when I introduce chemical equations and how to balance them. We work simple equations like, $2H_2 + O_2 \rightarrow H_2O$ and work up to balancing equations like $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$.

Balancing chemical equations does not come easy to most eighth graders. Most have not yet mastered solving simple numerical equations. I instruct them to think of it as a puzzle and not to stress. We work the first few out together. I show them how to draw a circle with the chemical symbol in it for each atom represented in the equation. We do our vocabulary for reactant and product. We look at the arrow in each equation, and I explain that it shows which way our reaction is going and that it is shows the reactants (on the left side of the arrow) that combine to form a new and different chemicals called products on the right side. Subscripts and coefficients are introduced. They must understand that the subscript only affects the element to the left of it while coefficients effect the entire chemical formula that they are attached to. The hardest thing for eighth graders to grasp is that they cannot change the subscripts. They can see that it is a rule and cease to do it as they become 8^{th} grade level equation solving experts. However, I am not sure if they ever truly understand that these equations represent changes of the substances.

The biggest concept that they do not see is how things are not destroyed in some chemical equations. They often ask if a tree burns, it all disappears, just like the paper that I rubbed between my hands. They need to visualize the formation of a gas. Most gases are invisible, so I have to rely on something that has bubbles that have staying power. One thing you can do is take a cold beaker or container and hold it over either the burning paper or the blow torch, and capture the water as it condenses on the cold container. This helps in at least identifying some of the products in the combustion reaction.

My students enjoy lab. In the ideal classroom, all students would learn how to work cooperatively with others, compete for fun and enjoyment, and work autonomously on their own.(7) Cooperation is working together to accomplish shared goals. Within cooperative situations, individuals seek outcomes that are beneficial to themselves and beneficial to all other group members. Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. This has been found to be successful in numerous studies and I have found it to work best during chemistry labs and write ups in my classroom.(8) I find that my gifted students not only try to take the lead if given the opportunity, but also aid a leader when the role for the group has been predetermined and given to someone else. I find that even my student that might have learning disorders, if grouped with the right peers, rises to the occasion and can even aspire to work harder than if left to work individually. The students with behavioral disorders have to be watched more carefully when in groups because they can tend to seek attention from the group, but if monitored closely, I have found that the amount of knowledge they take away from each lab along with the sense of success it gives them is well worth the effort.

Elephant toothpaste Demo 4 and Lab 5

Elephant toothpaste Lab

Lab Equipment

- A clean 16 ounce plastic soda bottle
- 1/2 cup 20-volume hydrogen peroxide liquid (20-volume is a 6% solution, get this from a beauty supply store or hair salon)
- 1 Tablespoon (one packet) of dry yeast
- 3 Tablespoons of warm water
- Liquid dish washing soap (dawn works best)
- Food coloring (I do this in October so use red to make it pink for breast cancer awareness)
- Small cup
- Tablespoon
- plastic spoon
- Safety goggles
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Note: Hydrogen peroxide can irritate skin and eyes, so I have my students wear safety goggles and gloves. I also lead any labs with any chance of danger by showing them each step as they go, in the front of the classroom.

<u>Procedures</u>

1. Add 8 drops of your favorite food coloring into the plastic soda bottle.

2. Add about 1 tablespoon of liquid dish soap into the bottle and swish the bottle around for about 10 seconds to mix it.

3. In the separate small cup, combine the warm water and the yeast together and mix for about 30 seconds with the plastic spoon.
4. Squeeze the cup slightly to form a type of spout. Pour the yeast water mixture into the bottle and observe.

<u>Questions</u>

1. Was there a chemical reaction? Explain how you know this.
2. What thins could you change if you wanted the foam to increase or rise higher from the bottle?

The students start the lab anxious to finish it. They want to know what is going to happen. I circulate around to the groups during each and every step to ensure that they are taking their time, following procedures and performing all steps correctly. The lab produces pink foam appearing considerably larger in size than the reactants that we started with. This is meant to make them ask questions. Some will say that there was something created. I ask them to refer to question number one, wanting them to answer their own questions. They already know that four observations can be used to identify if there has been a chemical reaction: color change, temperature change, formation of a gas and the forming of a precipitate. They realize that there are many bubbles involved and that bubbles are full of gas. So there has been a reaction. I question them about the phase of the ingredients (reactants) we started with. We started with a solid and a liquid. We end up with what we determine through further discussion is a liquid and a gas. Probing them with questions that I know will awaken some of their previous knowledge about the phases of matter and how the particles in them move, while adding in hints as I go, they eventually come to the conclusion that a gas fills more space than the solid or liquid and there may not have been anything created as they had first expected. This is an exothermic reaction but only has a slight temperature and most of the students would not notice it. My next step is to step up this experiment with a similar demonstration that will not only show the reason for the change in temperature, and will aid in explaining the phase change as well.

<u>Elephant Toothpaste Demo</u>

<u>Demo Equipment</u>

- 500 or 1000 ml graduated cylinder

- food coloring red or blue
- Dawn detergent
- 40% hydrogen peroxide (50% if you have a friend that is a hair dresser)
- saturated solution of potassium iodide (KI)
- disposable gloves
- goggles
- splint (optional)
- torch

Hazards:

1. Wear safety goggles and disposable gloves when pouring hydrogen peroxide, as it is an oxidant.
2. Do not stand over the graduated cylinder because steam and oxygen are produced quickly.

Procedure:

1. Put on disposable gloves and goggles.

2. Place a garbage bag or other covering on the lab table and possibly on the floor.

3. Fill the vial containing potassium iodide with water. Cap and shake until all the potassium iodide is dissolved. Set aside.

4. Pour 80 ml of 30% hydrogen peroxide into a graduated cylinder.

5. Add about 40 ml of Dawn detergent to the hydrogen peroxide. Swirl to mix

6. Tilt the graduated cylinder and drip red and/or blue food coloring down the sides of the graduated cylinder to make your toothpaste striped

7. Quickly add the saturated solution of KI solution and stand back be sure to move your hand away from the top of the graduated cylinder quickly or the hot foam will get on your hand and arm.

8. You may place a glowing splint in the foam to test for oxygen, but do not drop the splint into the graduated cylinder. The splint will relight indicating the presence of oxygen.

This demo takes the students a bit further in their reaction knowledge. The reaction creates much more gas, resulting in an almost explosion of foam exiting the graduated cylinder, making it very obvious that gas has been released. The other nice piece to this demo is that the foam produces enough heat that it actually steams. This is a great example of an exothermic reaction.

Reactions in a Baggie Lab

This lab asks what the students have learned about identifying signs of a chemical reaction, the difference between and endothermic and exothermic reaction, and the law of conservation of matter.

Equipment

- 1 set Measuring spoons
- 2 Zipper sandwich baggies
- 2 pipettes
- Dry active Yeast
- Teaspoon of Baking soda
- Vinegar
- Hydrogen peroxide
- Safety goggles

Note: Hydrogen peroxide can irritate skin and eyes so I have students wear safety googles and glove. (It also gives them the feeling they are really scientist) I also lead labs that include any dangers, by showing step by step processes as they go through them.

Procedures

1. Put 1 teaspoon of baking soda into a baggie.
2. Shake all the baking soda into one corner of the bag.
3. Squeeze the end of a pipette, place the tip in the vinegar, release and the pipette will fill with vinegar. Do not squeeze the pipette.
4. Place the pipette in the baggie.
5. Get out as much air from the bag as possible and seal the bag.
6. Squeeze the bulb pipette to release the vinegar and start the reaction!
7. Call teacher over for further instructions.

Questions

1. Did a chemical reaction take place?
2. How do you know if a chemical reaction took place?
3. What type of reaction was it? Explain
4. What happen with the glowing splint test? What does this mean?

Baggie Lab #2

<u>Procedures</u>

1. Put one pack of dry active yeast into the bag.
2. Shake all of the yeast into one corner of the bag.
3. Squeeze the end of a pipette, place the tip in the peroxide, release and the pipette will fill with hydrogen peroxide. Do not squeeze pipette.
4. Place the pipette in the baggie.
5. Get out as much air from the bag as possible and seal the bag.
6. Squeeze the bulb pipette to release the hydrogen peroxide and start the reaction!
7. Call teacher over for further instructions.

<u>Questions</u>

1. Did a chemical reaction take place?
2. How do you know if a chemical reaction took place?
3. What type of reaction was it? Explain
4. What happen with the glowing splint test? What does this mean?

The entire class starts the lab with me leading it in the front of the class. This eliminates a failure to follow instructions which limits the waste of materials. I add one step to the lab that the students will only observe. I have a scale in the front of the room and I weigh each bag before and after the chemical reaction takes place. The bag's appearance looks much different prior and following the reaction. What I want my students to see by my weighing the baggies are that the weight is exactly the same. No new mass/matter was created and no existing mass/matter was destroyed.

When the reactions happen in the first baggie the students should see bubbles form and the bag will inflate. I also have all the students feel the bag; it is cool to the touch. The change in temperature indicates a chemical reaction. The fact that the bag got cooler in temperature indicates an endothermic reaction. As soon as the reaction has occurred, I visit each group with a glowing splint. I open the bag, I put the splint in, and it either gets much brighter, or with optimum results, even relights. Many of the students will recognize that the gas that formed was probably oxygen.

The second baggie should also show immediate signs of a gas being formed with bubbles and the bag inflating. There is also a change in temperature, indicating a chemical reaction. This bag gets warmer to the touch. Again, all the students should have a chance to feel the bag, and I insert a glowing splint. This reaction causes the splint to immediately extinguish. Many of the students will recognize that the gas formed was carbon dioxide.

Conclusion

Many people think chemistry is something that only takes place when super intelligent people in laboratories put on lab coats and googles, and boggle each other's minds with their genius. It actually take place every day all the time in all our lives, we just don't normally recognize it for what it is. My students realize that it surrounds them and they welcome it. The purpose for my unit is to put their hands directly on science as much as possible and not fear it, use it, be interested in it. My main objective is they continue their schooling with more knowledge than they previously had, and enjoy and take in more from their future science classes. My ultimate success is when a student comes back and tells me they are pursuing a college degree in the field of science.

Works Cited

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Appendix 1: Implementing Common Core Standards

8. P.1
Understand the properties of matter and changes that occur when matter interacts in an open and closed container.

8. P.1.1 Classify matter as elements, compounds, or mixtures based on how the atoms are packed together in arrangements. Using discussion, notes and the activity Separation Challenge. Students must understand these basics for the rest of chemistry.

8. P.1.3 Compare physical changes such as size, shape and state to chemical changes that are the result of a chemical reaction to include changes in temperature, color, formation of a gas or precipitate. Students need to realize there is a difference between physical and chemical characteristics and changes. Kuzniar's don't show and don't tell is a fun way to start this process, followed by the rest of the unit, students understand and can use this principles.

8. P.1.4 Explain how the idea of atoms and a balanced chemical equation support the law of conservation of mass. 8^{Th} grade chemistry is all about the law of conservation of matter. Everything from properties, characteristics and reactions is all planned to gain understanding if this essential Law.

Appendix 2

Separation Challenge

This Challenge if you decide to accept it, and the most successful group will find themselves sitting down at lunch and enjoying a tasty heterogeneous mixture.

In this challenge you will attempt to separate a mixture made up of sand, sugar, and parsley. You task is to develop a way to physically separate the three parts of this mixture into to three separate containers. To accomplish this you may use any of the equipment I have supplied you with and anything else you find in the lab as long as you have acquired permission.

Materials used:
List anything you used to complete this task!

Procedure:
Be specific. I want to be able to redo your steps exactly as you did by reading your procedures. Please list procedure step by step!

Questions:

1. What type of mixture were you given? Explain how you know this.
2. Can you think of any other ways to separate this mixture?
3. How were the materials in the mixture similar? How were the materials different? Did this make them easier or more difficult to separate?

Extra Credit: On a separate sheet of paper, explain the steps you could take to separate out the sugar from the water.

Reactions in a Baggie

Make sandwich baggies pop and learn the Law of conservation of matter through simple chemical reactions!

Materials
1 set Measuring spoons
2 Zipper sandwich baggies
2 pipettes
Dry active Yeast
Baking soda
Vinegar
Hydrogen peroxide

1. Put 1 teaspoon of baking soda into a baggie.
2. Shake all the baking soda into one corner of the bag.
3. Squeeze the end of a pipette, place the tip in the vinegar, release and the pipette will fill with vinegar. Do not squeeze the pipette.
4. Place the pipette in the baggie.
5. Get out as much air from the bag as possible and seal the bag.
6. Squeeze the bulb pipette to release the vinegar and start the reaction!
7. Call teacher over for further instructions.

Writing response:

5. Did a chemical reaction take place?
6. How do you know if a chemical reaction took place?
7. What type of reaction was it? Explain
8. What happen with the glowing splint test? What does this mean?

Baggie Lab #2
1. Put one pack of dry active yeast into the bag.
2. Shake all of the yeast into one corner of the bag.
3. Squeeze the end of a pipette, place the tip in the peroxide, release and the pipette will fill with hydrogen peroxide. Do not squeeze pipette.
4. Place the pipette in the baggie.
5. Get out as much air from the bag as possible and seal the bag.
6. Squeeze the bulb pipette to release the hydrogen peroxide and start the reaction!
7. Call teacher over for further instructions.

Writing response:

1. Did a chemical reaction take place?
2. How do you know if a chemical reaction took place?
3. What type of reaction was it? Explain
4. What happen with the glowing splint test? What does this mean?

Bibliography for Teachers

B.K. Hixson, ***North Caroline Labbook (Grade 8)*** (Loose in the Lab, 2011). This is a grade level appropriate lab book. Labs are selected to be appropriate for the state standards.

Cathy Cobb and Monty L. Fetterolf, ***The Joy of Chemistry: The Amazing Science of Everyday Things*** (Amherst: Prometheus Books, 2005). This is a great book any middle grades level science/ chemistry teacher. It contains numerous labs, on grade level that can be performed in a regular classroom setting.

http://www.instructables.com/ (accessed Oct 10, 2013). This is a link that id DIY shared by many. Ideas on technology, science food etc... You can even build your own website for instruction from this one.

http://www.scholastic.com/teachers/article/40-cool-science-experiments-web/ (accessed Oct 10, 2013). This is a link that was designed by scholastic for teachers. Most labs on this site can be performs in the classroom or even at home.

http://www.scienceoutreach.org/science_mania/activities/ (e.Vanderbilt Center for Science Outreach and its programs are funded by Vanderbilt University Medical Center, Vanderbilt University, and by grants from the National Institutes of Health), (accessed Oct 5, 2013). This is a link was created by Jeannie Tuschli. It contains activities that serve much of the 8th grade science curriculum.

Loose in the Lab | Home of Seriously Funny Science *looseinthelabscience.com/* (accessed Oct. 8, 2013) this link contains ideas for labs and where to get supplies. I also is a supplier of poster and equipment and offers online workshops.

Reading and Activities list for Students

http://www.chem4kids.com/files/atom_structure.html, Give notes about the basics of chemistry from atoms to isotopes to even biochemistry. The notes are followed by quizzes so students can assess themselves.

http://education.jlab.org/atomtour/ this site helps the students brush up on everything about atoms. There is a section for resources, puzzles, games. I makes learning more fun.

http://www.funbrain.com/periodic/index.html This site contains a game that is perfect for teaching middle school students more about the periodic table.

http://www.kidzworld.com/article/2065-what-is-the-periodic-table-of-elements this site has written information, entertainment and advice on a wide range of educational avenues.

http://chemistry.about.com/library/blperiodictablekids.htm this site is interactive. I has a click on periodic table that allows students to access information about the elements.

http://www.classzone.com/books/earth_science/terc/content/investigations/es0501/es0501page06.cfm this site shows students how to read the periodic table and asses the number of protons, neutrons and electrons in each atom.

Recommended Vocabulary list

Acid: a substance that can donate a proton to another substance and has a pH below 7.
Alloy: A solid mixture composed of a metal and at least one other substance.
Atom: The smallest unit of an element, consisting of at least one proton and (for all elements except hydrogen) one or more neutrons in a dense central nucleus, surrounded by one or more shells of electrons.
Atomic mass: The total number of protons and neutrons in the nucleus of an atom.
Atomic number: The number of protons in an atoms nucleus.
Base: A substance that can accept a proton from another substance and has a pH above 7.
Boiling point: The temperature at which a liquid becomes a gas.
Chemical reaction: The process by which chemical changes occur, atoms rearrange and bonds are broken and formed.
Compound: A substance made up of two or more elements bonded together.
Concentration: The amount of a substance (solute) contained in another substance (solvent).
Conductivity: The property of a material that says it has the ability to conduct heat or electricity.

Dilute: A solution with a low concentration of the solute.
Electron: A negatively charged particle located outside of the atoms nucleus.
Element: A substance that cannot be broken down into a simpler substance by ordinary chemical changes.
Endothermic reaction: A chemical reaction in which energy is released.
Exothermic reaction: A chemical reaction in which energy is absorbed.
Family: The elements in a column on the periodic table also known as a group.
Group: The elements in a column on the periodic table also known as a family.
Half-life: The length of time it takes for half the atoms in a sample of a radioactive element to decay into atoms of another element.
Law of Conservation of Mass: A law stating that atoms cannot be created or destroyed in a chemical reaction.
Malleability: A materials ability to be formed into thin sheets by hammering or rolling.
Melting Point: The temperature at which a solid material changes into a liquid.
Metal: An element usually having the properties of conductivity, shiny, and a solid at room temperature.
Metalloid: The elements that have properties of both metals and non-metals.
Mixture: A combination of two or more substances that do not combine chemically and remain individual substances. They can be separated by physical means.
Molecule: A group of atoms held together by bonds.
Neutron: A particle with no electrical charge found in the nucleus of an atom.
Nonmetal: An element that is not a metal and has properties opposite of most metals.
Nucleus: The center of an atom where most of the atoms mass is found in its protons and neutrons.
Precipitate: A solid substance that forms as a result of a chemical reaction.
Product: A substance formed by a chemical reaction.
Proton: A positively charged particle found in the atoms nucleus.
Radioactivity: A process in which the nucleus of an atom releases energy and particles.
Reactant: A substance that is present in the beginning of a chemical reaction.
Reactive: Wants to undergo chemical change.
Solute: The part of a solution that is dissolved.
Solution: A mixture of two or more substances that is identical throughout.
Solvent: The part of a solution that dissolves the solute.
Suspension: A mixture in which the substances are identifiable as separate substances.