

Owlchemy Chemistry Demonstration Manual

Demonstrations at the Houston Museum of Natural Science <http://www.hmns.org/>

The main goals of our chemistry demonstrations:

1. Make chemistry interesting and keep the visitors interested. (By doing cool demonstrations and inducing audience participation)
2. Make chemistry accessible to the audience. (Help the audience understand a few concepts per show—don't confuse people by trying to explain too much.)

Keep this quote in mind when you try to turn your audience from a set of curious kids and jaded parents into interested, mindful scientists:

"It is a mind-set, not an explainable set of principles that makes a scientist. It is taking pleasure in questions and finding, within yourself, the resources to answer them. Science is mental awareness. It is the confidence to distrust explanation. The more we reduce science teaching to a set of explanations, the worse we sabotage understanding."

The closer you can bring the world of chemistry to your audience, the better. Maybe you have a better way to do this than the current demonstrators.

- This book contains demonstrations, explanations, and questions to ask the audience.
- Read the explanation and questions before doing the demonstration.
- The explanations are for your benefit. Don't just repeat the explanations to the audience especially the more complicated ones. Explanations don't make people interested in chemistry. The questions are for the audience. You may ask the questions as you see fit, or make up your own questions. Share your ideas with the rest of Owlchemy.

Safety Notes:

- Don't wear open-toed shoes (like sandals) to the museum.
- Always wear goggles and lab coats while doing demonstrations.

Prepared by: Daniel Heller (hellodan@rice.edu)

4/15/2000

and Freddy Nguyen (freddytn@rice.edu)

4/16/2000

Owlchemy (Student Affiliates of the American Chemical Society, Rice University)

<http://www.ruf.rice.edu/~owlchemy>

Comments should go to the current Owlchemy president or owlchemy@rice.edu

Contents

Liquid Nitrogen Demonstrations	4
Balloon	5
Flowers	5
Racquetball	6
Tennis Ball.....	6
Banana	7
Carbon Dioxide Balloon.....	7
Polymer Demonstrations	8
Skewer Through Balloon.....	8
Styrofoam/Envirobeads	9
Gak	10
Super Duper Polymer Gel.....	11
Sodium Polyacrylate (Diaper)	12
Exothermic Reactions	13
Methanol Bottle.....	13
Non-Burning Dollar Bill.....	14
Lycopodium.....	15
Fireworks.....	16
Miscellaneous Demonstrations	17
Disappearing Ink—Acids and Bases	17
Coke/Diet Coke—Density.....	18
Elephant’s Toothpaste (also exothermic)	19
Luminol—Chemiluminescence	20

Notes about Computer Technology at the Houston Museum of Natural Science Chemistry Hall

The chemistry hall at the Houston Museum of Natural Science currently contains a computer and video wall to show computer animations during our chemistry demonstrations. It also has a video camera positioned above the fume hood to show our demonstrations more closely.

To use the animations, the computer must be turned on and the video wall must be set to show what is on the computer. The password on the computer is “booboo”. The animations are in QuickTime 4. To run an animation, click on the icon next to the .mov file.

The animations can be used to explain what actually happens on the atomic scale when our demonstrations occur. To determine what animations you would like to use in your demonstration, try them out at the chemistry hall before you start your demonstrations.

Liquid Nitrogen Demonstrations

Safety Notes:

- Don't stick your hand or even your gloved-hand into liquid nitrogen.
- We get liquid nitrogen from the loading dock. Make sure you are wearing gloves when you go to the loading dock to get it.
- Make sure the kids stay far away from the liquid nitrogen dewar.
- Don't pour liquid nitrogen on or near kids.

Materials:

- Liquid nitrogen from loading dock
- Dewar
- Tongs
- Thermal gloves
- Balloon
- Flowers (optional)
- Racquetball and hammer (optional)
- Tennis ball (optional)
- Banana piece of soft wood such as balsa or pine, nail (optional)
- Dry ice (optional)

Procedures for showing nitrogen:

- Pour a little liquid nitrogen on the floor (not on kids!).
- Pour some nitrogen into a large beaker and leave on counter in the lab, watch it boil (do not touch beaker without gloves).
- Blow into the liquid nitrogen and see how water vapor in your breath condenses into steam.

Facts about nitrogen:

Nitrogen makes up about 80% of the air we breathe. Liquid nitrogen is -196 degrees Celsius (-322 degrees Fahrenheit, 77 Kelvin). Just like water boils at 100 degrees Celsius, liquid nitrogen boils at -196 degrees Celsius. It is often used by chemists, biochemists, and chemical engineers to cool things down (a lot). The steam that you see surrounding the liquid nitrogen is not gaseous nitrogen. It is water vapor, which condenses into water when it approaches the (really cold) liquid nitrogen. You may demonstrate this to the audience if you blow into the nitrogen dewar. Lots of steam will fly back up out of the dewar because your breath contains much water vapor. It's sort of like seeing your breath on a cold day.

Questions to ask about nitrogen:

What is it?

How cold is it?

Why does it stay that cold?

What is it doing?

Why is it boiling?

What are the differences between liquid nitrogen and water?

Everyday Life: Where do we find nitrogen in our everyday lives? What is the difference between the nitrogen we breathe and the nitrogen in the dewar?

Balloon



Procedure:

You may use this to demonstrate the scientific method (see below).

1. Blow up a balloon (no wider than the mouth of the dewar).
2. Place it into the liquid nitrogen using the tongs.
3. After the balloon has shrunk, remove it with the tongs, hold it for everyone to see, and let it grow again in the air.



Explanation:

Gas molecules move quickly. They hit the sides of the balloon like little punching bags, pushing out the walls of the balloon, exerting pressure. When we cool down the air molecules, they slow down and push out the sides of the balloon less than they did before (lessening the pressure). Some of the air in the balloon actually liquefies when placed in the nitrogen.



Demonstrate Scientific Method with the Balloon:

Before putting the balloon in the liquid nitrogen, ask the audience what will happen when we put the balloon in the nitrogen. Their answers will most likely be guesses. What do scientists call guesses? (Hypotheses.)

Why? (They are educated guesses.) How do we test out our hypothesis?

(Do an experiment!) After you dip the balloon and show it to the audience, ask the audience what they saw. (They make observations.) Now ask them what they think happened and why. (The audience will try to make theories about what is happening.)

Questions:

Did we take anything out of the balloon? Why was the balloon expanded in the first place? What is pressure? What causes pressure? Why did the balloon shrink?

Flower



Procedure:

1. Put one flower face down in the liquid nitrogen and hold it until the liquid nitrogen stops boiling.
2. Take the flower out and smash it on any hard surface.
3. Clean up the frozen flower parts after the demo.



Explanation:

Flowers are mostly water, just like people. The flower becomes very brittle because all of the water inside freezes.

Questions:

What are flowers made of (mostly)? What happens to the water in the flower when we dip it in liquid nitrogen? What are people made out of (mostly)? Why shouldn't you put your finger in liquid nitrogen?

Racquetball

Procedure:

1. Bounce the racquetball on the table to demonstrate how pliable the material is at room temperature. Toss the racquetball in the liquid nitrogen and wait for it to stop boiling (this takes a few minutes).
2. Take the racquetball out with a pair of tongs.
3. Drop it on the table and notice the sound it makes and that it does not bounce.
4. Lay it on the table and smash it with the hammer.
5. You can pass out pieces of the racquetball after it warms up to show it returns to its original state after it warms back up.

Explanation:

Rubber becomes very brittle when it is cold.

Questions:

What is a racquetball made of? Why does a racquetball not bounce after being exposed to liquid nitrogen? (Nitrogen changes the properties of the rubber to make it more brittle.)

Tennis Ball

Procedure:

1. Immerse a tennis ball in liquid nitrogen for 3 minutes.
2. Demonstrate the properties of a regular tennis ball by bouncing it on the floor.
3. Drop the frozen ball on the floor. Do not try to break the ball.

Explanation:

Rubber becomes very brittle when it is cold.

Questions:

What is a tennis ball made of? Why does a tennis ball not bounce after being exposed to liquid nitrogen? (Nitrogen changes the properties of the rubber to make it more brittle.)

Banana

Procedure:

1. Fully immerse an unpeeled banana in the liquid nitrogen and let it freeze until the liquid nitrogen stops boiling. This could take a long time perhaps 5 minutes. If you take it out too early the banana will break.
2. After it is sufficiently frozen remove the banana with the tongs and hold it with the thermal glove.
3. Use the banana to hammer a nail into the board or (if there is no nail or board), just break the banana.
4. Don't let kids touch the banana pieces when they are cold.

Explanation:

Bananas become very hard when the water freezes inside of them.

Question:

What are bananas made of that they become hard in liquid nitrogen?

Carbon Dioxide Balloon

Procedure:

1. Before the show, put a few pieces of dry ice into a balloon.
2. Tie it and wait a few minutes. The balloon should inflate.
3. During the show, dip it into the liquid nitrogen.
4. Cut it open and show the dry ice. Dry ice is -78 degrees Celsius (-108 degrees Fahrenheit).

Explanation:

Dry ice sublimates into carbon dioxide. Carbon dioxide sublimates into dry ice at -78 degrees Celsius or below. The forces holding the carbon dioxide molecules together are greater than those holding nitrogen together, so carbon dioxide takes longer to turn into a gas.

Questions:

What happened to the gas in the balloon? What is the gas in the balloon? Why did the carbon dioxide turn into dry ice?

Polymer Demonstrations

This is a good time to talk about polymers. Polymers are long chains of molecules. In simple polymers, every molecule in the chain is usually identical (such as polystyrene, where all molecules in the chain are styrene molecules).

You can ask everyone in the audience to join their neighbor's hand and tell each person that she/he is a molecule, and together they make a long chain. Or, you can demonstrate up in the front of the room making a people-polymer for the audience. When you are done with the demonstration, you can tell the members of the people-polymer to de-polymerize.

Skewer through Balloon



Materials:

- Mineral Oil or Baby Oil
- Balloon
- Skewer

Procedure:

1. Dip a skewer into mineral oil to coat at least half of its length.
2. Blow up a balloon about half full.
3. Start near the tie and poke the skewer through by slowly pushing and twisting at the same time.
4. Push the skewer through the very top of the balloon where there is slightly thicker rubber.
5. You can pull the skewer out of the balloon, but it might start to deflate.



Explanation:

The balloon is made of molecules (polymer chains) that stretch and seal around the needle. When the balloon is jabbed, the molecules do not have time to stretch and surround the needle. Lower rates of stress allow more time for the polymer molecules or chains to disentangle and move into a deformed state. Higher rates of stress actually cause the polymer molecules to break because they cannot respond quickly enough. This causes fracture, rupture or ultimate failure. The oil seals the area between the skewer and the balloon and also reduces friction, keeping the balloon from breaking.

Questions:

You may ask for votes of confidence about whether you will actually be able to stick it through without popping the balloon. Did we cheat? How did we cheat? What does mineral oil do that kept the balloon from popping? What will happen if we just quickly stuck the balloon with the skewer? Why does speed in pushing the skewer through make a difference?

Styrofoam / Acetone and Envirobeads/Water

Materials:

- Styrofoam
- Beaker (250ml or greater)
- Acetone (preferably in a squirt bottle)
- Envirobeads and water (optional)

Procedure:

1. Fill a beaker with Styrofoam before the demonstration.
2. During the demonstration pour the acetone over the Styrofoam and watch it melt away.
3. (Optional) Fill a beaker with Envirobeads.
4. During the demonstration, pour water over the Envirobeads and stir.

Explanation:

Both Styrofoam and Envirobeads consist of a polymer, which traps gas to make it fluffy and able to protect your packages from breaking. Styrofoam is made of polystyrene (many molecules of styrene linked together) and CO₂ gas trapped between polystyrene molecules. Squirting acetone (the main ingredient in nail-polish remover) over the Styrofoam causes the CO₂ gas to be released, leaving only the stringy polymer behind. Envirobeads are made of cornstarch polymerized into strands. When you put Envirobeads in water, the cornstarch dissolves. Styrofoam is an oil product, which means that we are draining a nonrenewable resource and it is also hard to dispose of making Envirobeads an attractive option.

Questions:

What is the main ingredient in Styrofoam? (CO₂ gas) Why would it be bad to get your package wet if it was protected by Envirobeads? Why might Envirobeads be better to use than Styrofoam?

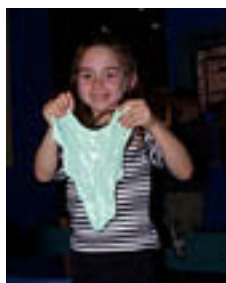
Slime (Gak)



Yea!! Kids love this demo. It is like Nickelodeon Gak, except cheaper. Kids can make it at home with their parents' permission.

Materials:

- 1000 ml Beaker or large bowl
- White Glue
- Water
- Food Coloring (optional)
- Borax solution
- Stirring Implement



Procedure:

1. Before the demonstration saturate a water solution with Borax.
2. During the demonstration mix an equal volume (50ml?) of glue and water in the beaker.
3. Add food coloring and mix well.
4. Slowly pour in the Borax solution while stirring vigorously. You should start to see slime.
5. Drain water out of the slime to let people play with it.

Note: Don't give out the slime for the kids to bring home.

Explanation:

This is a cross-linked polymer. The borax makes "bridges" between the polyvinyl acetate molecules of the glue. Like the balloon and the skewer, this polymer will deform if you stretch it slowly, but it will break if you pull it quickly. The glue is already a polymer (polyvinyl acetate), but when you crosslink it, it becomes more viscous.

Questions:

When does the mixture polymerize: When the glue is mixed with water? When food coloring is added? When Borax is added?

Super Duper Polymer Gel

Materials:

- 3-4g polyethylene oxide (aka Super-Duper Polymer Gel sold by Flinn Scientific)
- 20-25ml ethanol, methanol, or isopropyl alcohol
- 300ml water
- 2 beakers

Procedure:

1. Add the polyethylene oxide to the alcohol and stir. The polyethylene will not dissolve.
2. Add 300ml water to the mixture in one pour. Mix well.
3. During the demonstration: Hold one beaker, containing the mixture, above a lower beaker and begin to pour it into a lower beaker.
4. Slowly tip the upper beaker back into an upright position.
5. The polymer should start to “siphon” from the top beaker and keep pouring even when the top beaker is almost upright.
6. The polymer can be stored with a lid or Parafilm.

Explanation:

Polyethylene oxide is a polymer with a high degree of hydrogen bonding between molecules. In other words, the molecules of the gel “like each other very much.” This demonstration is also called the “tubeless siphon.”

Questions:

Why does it do that? (B/c molecules of the gel like each other, stick together). How could this be used in everyday life? (It’s used to thicken liquids such as shampoos, etc. It’s even in Dr. Pepper!)

Sodium Polyacrylate

Materials:

- About 1-2 grams of sodium polyacrylate
- 700 ml of water
- Stirring rod
- 1000ml beaker
- Salt (optional)

Procedure:

1. Fill a glass beaker to about 500-700ml full.
2. Add the sodium polyacrylate to the water and stir until completely gelled.
3. The resulting mixture will not be pour-able. If reaction is done in a small cup, one may be able to turn it upside-down without any falling out.
4. The mixture can be touched by audience members.
5. The process can be reversed by adding an ionic solid (salt, sodium bicarbonate).

Explanation:

Sodium polyacrylate is termed a hydrophilic or "water-loving" polymer because of its great affinity for water. So how does this polymer work? In the dry powdered state the chains of the polymer are coiled and lined with carboxyl groups ($-\text{COOH}$). When hydrated with water, the carboxyl groups dissociate into negatively charged carboxylate ions (COO^{-1}). These ions repel one another along the polymer chain thereby widening the polymer coils allowing water to move into contact with more carboxyl groups. As the polymer continues to uncoil the ultimate swelling forms a gel-like consistency. The polymer does not form a solution because it still has cross-linking due to hydrogen bonding where hydrogen atoms in water are being attracted to the oxygen atom in the carboxylate ions between chains. Basically, you can tell kids that the polymer is wound up like a spring at the beginning. Water makes the spring stretch, filling the spaces between each coil. If you have a spring, you can show this.

To reliquify the gelled polymer for disposal purposes, common table salt is added. When salt is added, each ion of sodium (Na) and each ion of chlorine (Cl^{-}) is quickly surrounded by six molecules of water, which is drawn out from the polymer-water complex. The presence of sodium chloride in the solution greatly decreases the ability of polyacrylate to absorb and retain water. Other ionic compounds such as baking soda or vinegar can also be used. Once the gel has been liquefied, it can be safely poured down the drain.

Questions:

What is sodium polyacrylate? (It's a polymer, which absorbs 825 times its weight in water.) How do you think it did that? What do you think happened on the molecular level? How can sodium polyacrylate be used in everyday life? (Diapers!)

Exothermic Reactions

Exothermic reactions release energy (heat). *Endothermic* reactions absorb heat. The reactions below are exothermic. An example of an endothermic reaction is a chemical cold pack that is used for sports injuries.

Methanol Bottle (Whoosh Bottle)



Materials:

- 5 gallon water bottle
- About 10ml methanol
- Match

Procedure:

1. Add methanol to bottle.
2. Immediately cover bottle with hand and keep covered to keep gas from escaping.
3. Roll bottle around to get the inside walls of the bottle covered with methanol.
4. Turn lights off.
5. Remove hand from top of bottle and quickly...
6. Throw match in. Be careful not to leave your hand near top of the bottle.

Explanation:

The bottle starts full of air containing the important chemical: oxygen. Methanol is quite volatile, which means it evaporates very quickly, turning into methanol vapor. When the methanol evaporates, you get a mixture of air (oxygen) and methanol in the bottle. Throw in a match (add energy), and the two chemicals react. This is a combustion reaction (self-sustained reaction between oxygen and another chemical). The reaction is exothermic (releases heat). After an initial whoosh, which uses up most of the oxygen, you may see the flame blink on and off (or “chug”) in the bottle. This occurs because there is still methanol in the bottle, but the oxygen is used up, so oxygen is drawn into the bottle from the opening, ignites, more oxygen is drawn into the bottle, and ignites until the methanol vapor is basically used up. The reaction produces carbon dioxide and water. If you were to immediately try this reaction again by adding more methanol, you wouldn't get a good reaction because the bottle is now full of carbon dioxide instead of oxygen.

Questions:

Relating to Energy: What do we add to the bottle to start a reaction? How does the bottle feel after the reaction? Does this reaction release energy into the environment or take in energy from the environment?

Relating to Chemical Reactions: Before reaction: What is in the bottle to start with? What reaction takes place? What is produced? Why did the reaction stop? Why can't we immediately add more methanol and a match and watch the reaction again?

Relating to Combustion: What does one need for a fire? Fuel, oxygen, energy. Why did the reaction stop? Why was there "chugging" after the initial "whoosh"? What is combustion?

Non-Burning Dollar Bill

It is not every day that you get to commit a federal offense in the lab and get away with it.



Materials:

- Dollar Bill
- Acetone
- Water
- Small Beaker

Procedure:

1. Make a 50% acetone, 50% water mixture in a small beaker.
2. Either borrow a dollar from the audience or soak one of your own for a few seconds.
3. During the demonstration: Take the bill out of the solution claim you have money to burn
4. Turn off all the lights.
5. Hold the dollar with tongs and light it with a match extinguish the match immediately.
6. Don't hold the burning dollar over the beaker in case the flaming acetone drips.
7. Shake out the fire when most of the flame has gone out (to make sure nothing chars).
8. You can let someone touch the dollar after the flame is out to see that the dollar is not hot.

Explanation:

Acetone (like alcohols) is very flammable and burns very cool. The alcohol burns off, but the bill is soaked with water so it will not burn. Wipe your brow that you will not be turned in for any federal offenses today.

Questions:

How does the dollar bill feel? Why isn't it hot after it has been on fire? Why didn't the dollar bill burn? What chemicals do you think we put on the dollar bill to make it do that?

Lycopodium



Materials:

- Lycopodium (Dragon's Breath)
- Match

Procedure:

1. Put about a nickel-sized pile of lycopodium in the center of your palm.
2. Light a match or have someone light a match for you.
3. Put the match between your middle and ring finger, with the lit part of the match hanging over the pile of lycopodium.
4. Make sure your hand is far away from your face or anyone else.
5. Lift your hand quickly so all the lycopodium flies up into the match and into the air.



Explanation:

Lycopodium is a fungal spore that is flammable only when in contact with enough oxygen. If you try to light it while it is sitting in a pile, nothing will happen. Lycopodium is only flammable when surrounded with enough air molecules. Therefore, it will only light up when you throw it into the air. This is like a grain silo explosion. In grain silos, explosions have occurred because the grain became flammable when it was concentrated enough in the air.



Questions:

What would happen if we lit the lycopodium while it sat in my hand? Why wouldn't it burn up while sitting in a pile?

Fireworks



Supplies:

- Sugar
- Potassium chlorate
- Test tube (small, disposable)
- Beaker full of sand
- Sulfuric acid (concentrated)
- Dropper
- Mortar and pestle
- Strontium nitrate (optional)
- Cupric chloride (optional)
- Barium chloride (optional)
- Magnesium metal (optional)
- Fume hood, outdoors, or a soon to be smoky room.



Procedure:

1. Using a mortar and pestle, grind to a fine powder equal parts sugar and potassium chlorate. (Grind them separately.)
2. Mix together the sugar and potassium chlorate.
3. Add to the mixture a spatula full of a metal salt (strontium nitrate, etc.) and mix thoroughly.
4. Fill the test tube about $\frac{1}{2}$ full with the mixture.
5. Push the test tube into the beaker full of sand so test tube stands upright.
6. To start demonstration (in desired location), add one drop of sulfuric acid and stand back.

Explanation:

This reaction is like fireworks because they use different metal salts to cause the different colors. Every element burns in its own characteristic color—strontium happens to burn red. The reaction between sugar and potassium chlorate is more complicated to explain. Sulfuric acid is used to start this demonstration because the reaction between sugar and sulfuric acid creates heat.

Questions:

What happens when you burn metal? Where do you see this type of reaction out in the “real” world?

Miscellaneous Demonstrations

Disappearing Ink

Materials:

- Ammonia
- Phenolphthalein
- Beaker
- Eye dropper
- White lab coat on your partner

Procedure:

1. Mix a pinch of phenolphthalein with ammonia in a beaker. The solution should turn pink.
2. Using the dropper, drip some pink solution onto the back of a white lab coat while showing the audience.
3. Have your partner turn to face the audience and wait about 30 seconds.
4. Turn your partner with his back to the audience again to show how the ink has disappeared.

Explanation:

Phenolphthalein is an indicator, which turns pink in the presence of a base. Ammonia is a base. Cotton, however, is acidic, and will cause the phenolphthalein to turn clear again.

Questions:

What could this be used for?

Coke/Diet Coke

Materials:

- One can of Coke and one can of Diet Coke
- Two 1000ml beakers
- Water
- Two arm balance (optional)
- Sugar (optional)

Procedure:

1. Fill both beakers about 2/3 full with water.
2. Put one can of soda in each beaker.

Explanation:

Coke has sugar while Diet Coke has artificial sweetener, making Coke denser than water. This causes Coke to sink while Diet Coke floats in water.

Questions:

Why does this happen? Why does anything float or sink? What is density? Do all heavy things sink? Do all light things float?

Elephant's Toothpaste

This is a quick, easy, fun, and messy demonstration. It demonstrates the concepts of: catalysts (catalysis), exothermic / endothermic, and it is easy to point out the reactants/products of the reaction.



Materials:

- Large (1000L) graduated cylinder
- 30% Hydrogen peroxide
- Potassium iodide
- Liquid soap
- Food coloring (optional)

Procedure:

1. For easy clean up, spread paper towels or a pan beneath the graduated cylinder
2. Add a couple of grams of potassium iodide (amount to cover the bottom of the cylinder).
3. Add about the same amount of soap (5-10 ml).
4. Put a drop of food coloring on the inside wall of the cylinder to make a "stripe."
5. To initiate the reaction, add about 10ml of 30% hydrogen peroxide.

Notes:

Be careful not to spill it on yourself. After you're done with the show, be sure to clean out the cylinder. All measurements are inexact in this demonstration. You basically add a "little bit" of potassium iodide, hydrogen peroxide, and soap. Just don't add too much peroxide or stuff will hit the ceiling.

Alternate:

Glowing Elephant's Toothpaste: If store-bought light sticks and manganese dioxide are available, you may use them to do "Glowing Elephant's Toothpaste. It is very similar to the regular kind except you start by putting into the graduated cylinder: H_2O_2 , soap, and the contents of a light stick which has already been activated. Turn the lights off. You then add a small amount of manganese dioxide (the catalyst). The reaction should occur and glowing toothpaste will grow in the tube.

Explanation:

Hydrogen peroxide, H_2O_2 , is not very stable and readily separates into water and molecular oxygen. Potassium iodide acts as a catalyst in the reaction, greatly speeding up the decomposition of H_2O_2 . The potassium iodide is not "used up" in the reaction. It stays in the bottom of the cylinder and does not turn into anything else. The reaction is exothermic (releases heat) and the water created is in the form of steam. By adding soap to the reaction, the gases are trapped in bubbles instead of escaping.

Questions:

What is in the bubbles? What takes up all of the space in the cylinder after we start the reaction? (Gas) What would happen if I didn't put any soap into the graduated cylinder? Hydrogen peroxide is turning into water and oxygen all the time; what happens when I add the other chemical? (It speeds up the reaction.) Why would a catalyst be useful in everyday life?

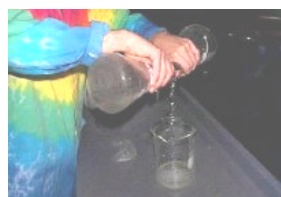


Luminol

Make the Luminol solution right when you get there as it takes a while to stir and dissolve. This reaction is an oxidation. If you are really interested! Have a six or seven page long explanation of this reaction. You can also mention that this reaction is very similar to the reaction that occurs in fireflies and the reaction that happens in those glow necklaces.

Materials:

- Luminol (3-Aminothalhydrazide)
- Sodium hydroxide
- Bleach
- Water
- One 600ml beaker
- 1000ml beaker
- Stir plate and stir bar
- Two Erlenmeyer flasks
- Something to pour the solutions into (Hopefully the glass helix but could be just another beaker or a Florence flask.)



Procedure:

1. Mix .8g of Luminol, 4g NaOH flakes, and 400ml of water and stir on the stir plate;
2. Gently heat this solution on the hotplate.
3. Into the 1000ml beaker pour 400ml bleach and 600ml of water.
4. Take the first solution, put it in a beaker and dilute it to 1000ml.
5. For each demo pour 250ml of each solution into an Erlenmeyer flask.
6. During the demonstration: Pour the two solutions such that they mix as they are being poured into the Glass helix or beaker.

Explanation:

This reaction releases its energy in the form of light instead of lots of heat. It is similar to the reaction inside of a firefly and those little light sticks that you can buy.

Questions:

Where can you see this reaction in nature? What kind of energy is released in this reaction?