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A Needle through a Balloon

Devin Quinn – Post Baccalaureate

MATERIALS:
Balloons
Long wooden or metal skewers
Petroleum jelly
A sharp pin
Cellophane tape

SETUP:
1. Blow up a balloon to a medium size
2. Take your sharp pin or skewer and cover its entirety in Vaseline.

PROCEDURE:
1. Take the skewer and insert it into the balloon at the end opposite the knot
2. Push the skewer all the way to the middle of the balloon
3. No pop!
4. With a different balloon insert the skewer through the side of the balloon
5. Pop!
6. Now place a piece of tape on the side of the balloon and insert the skewer
7. No pop!

EXPLANATION:
Polymers explain why the balloon does not pop. Polymers often cross-link which facilitates the stretchy nature of the balloon. The rubber at the ends of the balloon is less stretched out than those on the side. This is evident in the different coloration observed at the balloon's ends. Inserting the pin through the sides does not work, but adding a piece of cellophane tape stabilizes the polymer cross links keeping the balloon intact.

SAFETY:
Wear safety goggles as balloons will pop.

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Fireproof Balloon
Devin Quinn – Post Baccalaureate

MATERIALS:
2 round balloons; not inflated
Water
1 matchbook at least half full of matches

PROCEDURE:
1. Inflate one balloon and tie shut
2. For the second balloon add ¼ cup water, then inflate it and tie shut
3. Light a match and hold in under the balloon with no water (the balloon will break)
4. Light another match and hold it under the second balloon (has water)
5. The balloon with water does not break!

EXPLANATION:
Without water the balloon breaks quite easily, sometimes the flame does not even have to touch it. The balloon with the water inside does not break. The water absorbs the heat from the match saving the rubber balloon from breaking. Water is a fantastic absorber of heat because it has a high specific heat capacity.

SAFETY:
Care should be taken when handling matches to avoid accidental fires and burns.

`

An Alternative way to Inflate Balloons
Devin Quinn – Post Baccalaureate

MATERIALS:
3 Packages of Pop Rocks Candy
3 24oz bottles of soda
Balloons

SETUP:
Prepare 2 of the 3 balloons by placing one packet of Pop Rocks into each of the two balloons.

PROCEDURE:
1. Use a narrative to explain why you needed to find an alternative way to inflate balloons
2. Take the pop rocks and put one package into the final balloon (the other 2 balloons should be prepared).
3. Carefully, take each balloon and place it over the mouths of the three soda bottles
4. Watch the balloons inflate!

EXPLANATION:
The reaction that takes place when the candy is introduced to the soda produces CO2 gas. The carbon dioxide rises and fills the balloons. In fact the popping sound you hear and sensation you experience when eating Pop Rocks is explain by the escaping CO2 molecules.

SAFETY:
NO SAFETY CONCERNS.

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The Aggravating Gold Fish in the Ziploc Bag
Devin Quinn - Post Baccalaureate

MATERIALS:
Ziploc bag gallon size
Sharp number two pencil
32 oz. water

SETUP:
32 ounces of water should be added to the Ziploc bag before the demo begins.

PROCEDURE:
1. Tell a narrative about purchasing a gold fish over the weekend. The gold fish was a magical fish that could speak! Problem was the fish was a big jerk. The fish insulted you, calling you ugly. Fuming mad you take a sharp pencil and try to hurt the fish.
2. Push the pencil through the Ziploc bag . . . no leaks!

TIPS:
Pushing the pencil through the Ziploc bag slowly, as opposed to rapidly, will increase the likelihood that no leaks will form.

EXPLANATION:
Polymers can explain why the bag did not leak when the pencil was pushed through both walls of the bag. Essentially, when the pencil is inserted into the Ziploc bag the polymers are disrupted. The monomers created during the disturbance find new places to bond, which helps seal the two wounds created by the pencil.

SAFETY:
1. This demo should not be performed near electronics for risk of water spills.
2. Water spills should be attended to promptly.

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Elephant Toothpaste
Elizabeth Garren - Biology Senior

MATERIALS:
1 plastic water bottle
1 9 x 13 cake pan
1 small container
2 Tablespoons warm water
1 teaspoon yeast
½ cup 6% hydrogen peroxide
4-5 drops food coloring
1 squirt of dish soap

SETUP:
No advanced set up is necessary.

PROCEDURE:
1. Place plastic water bottle in middle of cake pan
2. Mix warm water and yeast in a small container and swirl for one minute
3. Mix hydrogen peroxide, food coloring, and a squirt of dish soap in the plastic water bottle
4. Pour the yeast mixture into the water bottle and watch the elephant toothpaste explode!

TIPS:
6% hydrogen peroxide cannot be found at a regular grocery store, it can be bought online or a 20 volume clear developer from a beauty supply store will work just as well.

EXPLANATION:
Hydrogen peroxide naturally breaks down into water and oxygen. In this demo, the yeast acts as a catalyst to speed up this reaction, the dish soap catches the released oxygen, and the bubbles burst out of the water bottle. The water bottle also feels warm following the reaction, signaling the release of energy as heat, or an exothermic reaction.

$$2\ H_2O_2 \rightarrow 2\ H_2O + O_2$$

SAFETY:
6% hydrogen peroxide can irritate the eyes and skin, safety goggles should be worn and any contact with the skin should be washed immediately.

SOURCE:
www.stevespanglerscience.com

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Restaurant Napkins
Elizabeth Garren - Biology Senior

MATERIALS:
2 paper napkins
2 glasses
Water
Table salt

SETUP:
No advanced set up is necessary.

PROCEDURE:
1. Fill two glasses with water
2. Drop some water on bottom of glasses to emulate condensation
3. Place one glass on napkin and lift up to show the glass sticking to the napkin
4. Sprinkle salt on other napkin
5. Place the second glass on this napkin and lift up to show the glass does not stick to the napkin

EXPLANATION:
Water molecules create a surface tension due to the fact that water is dipole. The electrons are slightly off balance in each molecule, causing the water to stick together. This is why the first glass sticks to the napkin. Salt is an ionic compound, that when dissolved in water, releases positive and negative ions. This dissipates the surface tension, stopping the second glass from sticking to the napkin.

SAFETY:
Always be careful when working with glass objects.

SOURCE:
www.darylscience.com

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Surface Area Reactions
Elizabeth Garren - Biology Senior

MATERIALS:
2 Alka Seltzer tablets
2 empty film canisters
Water

SETUP:
No advanced set up is necessary.

PROCEDURE:
1. Place one Alka Seltzer tablet in a film canister
2. Crush the second Alka Seltzer and place the pieces in the second film canister
3. Fill both film canisters ¾ of the way full with water and tightly press on both caps
4. Wait and see which lid pops off first!

TIPS:
Remember to label each canister with which Alka Seltzer tablet it contained. This will help eliminate any confusion after the caps blow off.

EXPLANATION:
This activity demonstrates that chemical reactions will occur at a quicker rate over a larger surface area. The crushed Alka Seltzer canister lid should pop off first due to the quickened rate of the reaction. The gas released during the reaction creates the pressure inside the canister and that is what causes the lid to pop off.

SAFETY:
The film canister caps popping off can be potentially dangerous. Remember to wear safety goggles at all times.

SOURCE:
http://www.alkaseltzer.com/as/student_experiment.html

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SUNKEN ICE CUBES
Mel Daghestani – Earth Science Senior

MATERIALS:
Two large beakers
Water
Rubbing Alcohol
Ice Cubes
Water cooler to hold ice cubes
Tongs

SETUP:
Fill one beaker with water and the other with rubbing alcohol ahead of time.

PROCEDURE:
1. Fill one beaker with water and the other with rubbing alcohol ahead of time
2. Place ice cubes in water beaker and then ice cubes in rubbing alcohol beaker
3. Repeat process with ice cubes from water beaker to show that they don't float as well
4. Take cubes from alcohol beaker and place in water beaker.

TIPS:
Begin experiment with different expectations of the two glasses

EXPLANATION:
People tend to jump to conclusions when things appear to be identical. Fill one beaker with plain water. In another beaker, place alcohol (rubbing alcohol from the drug store is fine but any other alcohol will work). The beakers will look essentially identical. Place an ice cube in each beaker. The ice will float in the water because its density (0.9 g/cm3) is less than the density of water (1 g/cm3). The ice will sink in the alcohol because the density of the ice is more than the density of alcohol (0.8 g/cm3). This is a great demo to introduce density because it really surprises the students and gets them to think.

SAFETY:
Keep rubbing alcohol away from flammable items such as matches, lighters, and other chemicals.

CREDIT:
Credit for this demo goes to Dr. Courtney Willis (University of Northern Colorado)

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Coloring Without Crayons
Adrianne Larson-Biology Post Bac

MATERIALS:
1 large piece of paper
Phenolphthalein indicator
0.1 M sodium hydroxide
5 ml vinegar
Paintbrush and cotton balls

SETUP:
1. Prior to the demo, use a paintbrush dipped in the phenolphthalein indicator to paint a picture on the large piece of paper.
2. Make sure the picture is dry before the experiment--the picture will disappear as it dries off. PROCEDURE: 1. Draw a picture on the paper using the phenolphthalein indicator. 2. Let it dry--it will appear colorless on the paper.
3. Next, dip a cotton ball in the sodium hydroxide solution and wipe it over the paper where the drawing is. The drawing should appear.
4. To make the drawing disappear again, dip a cotton ball in vinegar, and wipe it over the picture once again. The drawing should disappear.

TIPS:
MAKE SURE TO HAVE A LARGE PAINTBRUSH TO DRAW A PICTURE WITH.

EXPLANATION:
The piece of paper is slightly acidic, and the phenolphthalein indicator is also acidic, as can be seen from the way it is colorless on the paper. The sodium hydroxide, however, is a base containing hydroxide ions (OH-), so when it is added to the picture, it turns the indicator a bright pinkish color. Vinegar, when added to the picture, will make the drawing disappear because it is a weak acid, leading to a colorless picture once again. Therefore, with the aid of an indicator, an acid/base reaction will occur and will show color changes on a piece of paper.

SAFETY:
There are no particular safety precautions for this experiment. However make sure to have appropriate waste disposal. Dispose of the remaining vinegar, indicator, and sodium hydroxide down the sink. Throw the picture away in the garbage.

Acid Base Reaction:
Vinegar or acetic acid + Sodium Hydroxide ---> Sodium Acetate + Water
$HC_2H_3O_2 + NaOH \longrightarrow NaC_2H_3O_2 + H_2O$

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The Magic Sponge
Cassie Waldron-Biology Graduate

MATERIALS:
1g Congo red indicator
Hydrochloric acid, HCl, 1M, 100mL (or any acid solution that can be below a 3.0 pH level)
Sodium hydroxide, NaOH, 1 M, 100 mL (or any base solution that can be above a 5.2 pH level)
1 100 mL beaker
2 1000 mL beakers or large jars
Red food coloring, 1 mL
Blue food coloring, 1 mL
Sponge
Tongs
Rubber gloves

SETUP:
Sponge preparation:

Make a 1% solution of Congo red indicator by adding 1 g of Congo red to 100 mL of distilled or deionized water. Rinse the sponge with water to remove any excess soap or other residual materials. If the sponge is too large for the beaker or container for the solution, cut the sponge in half. Place the sponge in the Congo red solution, immersing it completely. Wear rubber gloves to keep from staining hands, and periodically squeeze out the liquid. Allow the sponge to soak for about 15 minutes. Squeeze out as much liquid as possible and rinse with water a few times. The indicator sponge is ready to use. Other indictor sponges can be made with the remaining solution.

Demonstration Preparation:
1. Add 15 mL of 1 M hydrochloric acid to a 1000- or 2000-mL beaker. Fill the beaker about 3⁄4 full with tap water.
2. Add enough red food coloring (about 1 mL per 1000 mL solution) to the acid solution in the beaker until it is a deep red color.
3. Add 15 mL of 1 M sodium hydroxide solution to a 1000- or 2000-mL beaker. Fill the beaker about 3⁄4 full with tap water.
4. Add enough blue food coloring to the basic solution in the beaker until it is a deep blue color.
5. If the sponge is red, then wet the sponge with tap water and rinse it out.
6. If the sponge is blue, place the sponge in the base solution to convert it to a red color

PROCEDURE:
1. Slowly place the red sponge into the beaker containing the red acid solution. Use tongs or a gloved hand. The sponge will immediately turn blue.
2. Remove the sponge and squeeze out as much red acid solution as possible back into the acid beaker or another large container containing water.
3. Slowly place the blue sponge into the beaker containing the blue base solution. Use tongs or a gloved hand. The sponge will immediately turn red.
4. Remove the sponge and squeeze out as much blue base solution as possible back into the blue beaker.
5. Rinse the sponge in tap water, to show that the sponge is actually red.

`

TIPS:

Optional: Rinse the sponge in tap water after submerging the sponge in the red solution to show that the sponge is actually blue and will not turn back to red. This step also minimizes the amount of acid and base being transferred between solutions. If most of the liquid is squeezed out of the sponge, this step may not be necessary.

EXPLANATION:

Congo red is used as a pH indicator. The color transition is between pH 3.0 and 5.0. Below a pH of 3.0 (very acidic solutions), the indicator is blue. Above pH 5.0, the indicator is red. When a cellulose sponge is soaked in a Congo red solution, the dye becomes permanently bonded to the cellulose fibers. The active acid/base sites on Congo red are still available and the sponge now becomes an indicator sponge for acids. This sponge is great to have around any science lab so it can also be used to check for acid or base spills on counters after students have used acids or bases.

SAFETY:

Hydrochloric acid is corrosive to skin and eyes and toxic by ingestion and inhalation. Sodium hydroxide solution is corrosive to skin and eyes. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Neutralize the acids and bases before disposal.

SOURCE:

http://www.flinnsci.com/media/395449/cf10376.pdf

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Rainbow Dry Ice Titration
Cassie Waldron - Biology Graduate

MATERIALS:
Universal indicator
Large graduated cylinder (any other glass container will work)
Dry ice
Heavy gloves for dry Ice (or tongs)
3-5 mL of 1M NaOH (or other strong basic solutions)
Distilled water
Long stirring rod

PROCEDURE:
1. Fill the 2L graduated cylinder with water and add enough universal indicator to have an easily visible color 2.
2. Add a few milliliters of NaOH to make the solution basic (it should be a blue-violet color) 3.
3. Stir solution with stirring rod to mix solution thoroughly 4.
4. Add several chunks of dry ice to the solution. 5.
5. As the CO_2 from the dry ice reacts with the water in the solution the solution will turn from a blue-violet to maybe a light orange.

TIPS:
Any basic solutions can be used, such as ammonia but since it is weaker it will be a green-blue color when added. Then, to show the full color range a few milliliters of a strong acid (like HCl) to make it a red color.

EXPLANATION:
The CO_2 from the dry ice reacts with the water in the solution to produce carbonic acid. The gradual change from a weak base to an acid will take the universal indicator through a range of colors. This can be used to talk about neutralization when acids and bases are mixed. It could also be used to talk about what happens in titrations of weak acids and strong bases (buffers).

SAFETY:
Wear safety glasses. Be careful handling the dry ice, use tongs or a thick glove. Be cautious if using a strong acid or strong base since it is corrosive to skin and eyes. Neutralize the solution before disposal

Source:
http://www.youtube.com/watch?v=orW7CEwcAW8&edufilter=DRJEhfx13A6rjbBlvoP0Bg

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The Dissolving Cup
Cassie Waldron-Biology Graduate

Note: In this lab, the Styrofoam is no dissolved, it is degassed. If the Styrofoam were to dissolve there would be so 'slime' left over. If it were to dissolve it would become part of the liquid.

MATERIALS:
A clear flattish container (a bowl, baking pan, pie plate, etc.)
50 mL water in a 100 mL glass beaker
50 mL acetone in a 100 mL glass beaker (this can be replaced by fingernail polish)
2 Styrofoam cups

PROCEDURE:
1. Hold one cup over the container and pour water into the Styrofoam cup (nothing happens). 2.
2. Pour acetone into another Styrofoam cup (the bottom will fall out) into the container. 3.
3. Finish by putting the cup into the container and watching it disappear.

TIPS:
A clear container works best so people can see the cup dissolving.
Optional: A person can start with two containers and put about 1/2 inch of acetone in the bottom of one and the same amount of water in the second one. Then place a cup in each container and watch one disappear.

EXPLANATION:
This is a demonstration of how like dissolves like. Styrofoam is a polymer consisting of a long chain of monomers that are held together by non-polar bond interactions, thus Styrofoam is non-polar. When the acetone a non-polar solvent, is poured into the cup it dissolves because they are both non-polar. The cup did not dissolve in the water because water is polar and will not dissolve a non-polar substance. Make sure to clarify to your classroom that the cup is not melting in the acetone (it's not hot enough to melt), it is dissolving because of their similar polarities.

SAFETY:
Dispose the "melted" solid into the trashcan. You can leave the acetone in the pie plate and allow it to evaporate and then wash out the container, or you can pour off the extra liquid down the drain.

`

Color Changing Water
Brooke Lyons - Biology Post-bac

MATERIALS:
Two transparent cups or other similar containers
A drinking straw
pH indicator such as bromothymol blue
Tap water

SETUP:
1. Half fill each cup with tap water.
2. Add a few drops of bromothymol blue to each of the cups. The water will appear a pale blue color. PROCEDURE: 1 Insert a drinking straw and gently blow bubbles into the water for several minutes. 2 After a short time (usually less than a minute), the water will change color.
3. Compare the color of the bubbled water with the color of the water in the other cup.

TIPS:
Bromothymol blue can be found at most pet and aquarium stores.

EXPLANATION:
When you blew into the water you will have noticed that the water changed from the original blue color to a green, possibly pale yellow color. This indicates that the water has changed from neutral to acid.

We describe whether things are acidic, basic or neutral by using a scale called the pH scale. Pure water has a pH of 7 and is regarded as neutral. The pH of solutions range from 0 for a very strong acid, 3 - 5 for weak acids, 8 - 9 for weak bases, and 13 - 14 very strong bases.

With every breath, we take in oxygen and exhale carbon dioxide. By blowing into the water you are adding carbon dioxide (CO_2), making the water slightly acidic.

When carbon dioxide is bubbled through water, some of it dissolves into the water. That is, some of the carbon dioxide goes into the spaces between water molecules. A small proportion of this dissolved carbon dioxide creates carbonic acid, a weak acid.

SAFETY:
Be careful not to blow too hard into the water so that it doesn't splash into your eyes. It may be a good idea to wear safety goggles for this demonstration.

`

Color Changing Milk
Brooke Lyons - Biology Post-Bac

MATERIALS:
Dinner plate or pie dish
Milk (whole or 2% works best)
Liquid food coloring – red, blue, green, and yellow
Cotton swab
Liquid dish soap

SETUP:
1. Pour enough milk into the plate to completely cover the bottom to the depth of about ¼ inch.
2. Add one drop of each of the four colors to the milk. Keep the drops close together in the center of the plate of milk.
3. Have soap and cotton swab nearby.

PROCEDURE:
1. Have students predict what will happen if cotton swab is placed in the milk. After they make a prediction, just touch the swab to the center without stirring the colors around. Ask students if anything happened.
2. Now add a drop of liquid dish soap to the other end of the cotton swab and place in the middle of the milk and food coloring. Hold the swab in one place for 10 to 15 seconds. The colors should rapidly swirl and mix.
3. Ask students what is making the food coloring in the milk move.

EXPLANATION:
Milk is mostly water but it also contains vitamins, minerals, proteins, and tiny droplets of fat suspended in solution. Fats and proteins are sensitive to changes in the surrounding solution (the milk).

The secret of the bursting colors is the chemistry of that tiny drop of soap. Dish soap, because of its bipolar characteristics (nonpolar on one end and polar on the other), weakens the chemical bonds that hold the proteins and fats in solution. The soap's polar, or hydrophilic (water-loving), end dissolves in water, and its hydrophobic (water-fearing) end attaches to a fat globule in the milk. This is when the fun begins.

The molecules of fat bend, roll, twist, and contort in all directions as the soap molecules race around to join up with the fat molecules. During all of this fat molecule gymnastics, the food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity. As the soap becomes evenly mixed with the milk, the action slows down and eventually stops.

SAFETY:
No safety considerations.

SOURCE:
http://www.stevespanglerscience.com/lab/experiments/milk-color-explosion

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Fire Balloons

Materials:

2 latex balloons
water
your lungs
long candle lighter

Set-up:

Fill one balloon with air and tie off.
Fill one balloon with water and tie off.

Procedure:

Light the lighter under the air balloon, it should pop.
Light the lighter under the water balloon, it should remain intact.
Suggestions
Move the flame around when lighting the water balloon, you can still melt the latex if you hold it in one place too long
You could try different mixtures of water and other soluble substances, I tried soda (it doesn’t work the same as the water balloon)

The Science

The specific heat of water allows it to absorb the heat energy from the flame and distribute it away from the latex keeping it from burning and popping the balloon. The same concept applies to why a pot of boiling water never gets hotter than the boiling water

`

Fire Extinguisher

Materials

Large pitcher
Small tea candles
Long candle lighter
Vinegar
Baking soda

Procedure

Light the candles with the lighter
Pour a small amount of baking soda about a tablespoon's worth into the pitcher
Pour about a cup or two of baking soda on top of that
Cover the top to let the reaction occur
Slowly tip the pitcher carefully so no vinegar spills out and the fire should extinguish

The Science

The vinegar-baking soda reaction generates a lot of carbon dioxide (it's what's in the bubbles). This carbon dioxide pools in the pitcher and when you tip it the gas pours out of the pitcher and extinguishes the flame. This happens because carbon dioxide is denser than oxygen. When it is poured onto the candles the CO2 pushes the oxygen out of the way. Since fire needs oxygen when there is an absence of oxygen there is an absence of fire.

`

How much water can a penny hold?

Materials:

Penny
Eye-dropper
liquid dish soap
glass of water

Procedure:

Use the eye dropper to place drops of water on the face of the penny. Record the amount of drops the penny can hold before the water spills over. Dry off the penny. Add about a tablespoon of dish soap to the glass of water and stir. Now use the eyedropper to place soapy water on the penny. Record the number of drops it holds.

Explanation:

Water has unique characteristics. We are observing two of them during this demo. The adhesive property of the water is what holds it to the face of the penny. The cohesion effect is seen as surface tension. The water holds itself together and creates a dome over the face of the penny. The soap reduces the cohesive force and does not allow the water to make as big of drops. The drops of soapy water are smaller and therefore the penny can hold more of them.

`

Hole-y Water

Materials:

powdered sugar
a glass of hot water filled up to the rim
teaspoon

Procedure:

Use the teaspoon to slowly sprinkle the powdered sugar into the filled cup of hot water. Do not let the teaspoon touch the water. Repeat.

Explanation:

The sugar dissolves in the hot water and fills the empty spaces around the water molecules. This is why the sugar doesn't overflow the cup.

`

Salt Water Eggs

Materials:

2 raw eggs
2 clear drinking cups
tap water
salt
balance

Procedure:

Fill both cups with equal amounts of water. Add five tablespoons of salt to one cup and stir. carefully crack an egg open and set it on the fresh water cup. Crack the second egg and place it carefully in the saltwater cup. Observe what happens. Weigh the cups.

Explanation:

The salt added to the water increased its density. This increase allowed the egg to float on the salt water because the egg is less dense than the salt water. The salt made the water heavier. The egg in the freshwater sank because it is heavier than the freshwater.

`

Acetone and Styrofoam

Note: In this lab, the Styrofoam is no dissolved, it is degassed. If the Styrofoam were to dissolve there would be so 'slime' left over. If it were to dissolve it would become part of the liquid.

Materials:

2 empty tin food cans (16oz)

Acetone

Styrofoam

Procedure:

Show how much Styrofoam you can put into one empty can. Then show that you can put much more Styrofoam into anther cup (hidden acetone in bottom) of the exact same size.

Science:

Acetone is a solvent and is able to dissolve things. It can dissolve the chemicals that make up Styrofoam, and being that it is mostly air you can add much more of it to the cup with the acetone than the other.

`

Magic Sand

Materials:

Sand

cookie sheet

scotch-guard (the sand has to be baked, the instructions are online)

Procedure:

Pour some sand into a clear bowl or cylinder so everyone can see. The sand will hold it's form while underwater. Now reach in and pull some of the sand out of the water. The sand will be completely dry again as if it had never been in the water.

Science:

By coating the sand with scotch guard it does not allow the sand and water to mix as it normally would and actually acts like it is hydrophobic.

`

Water and String

Materials:

2 Cups

Water (about ¾ of one of the cups you'll use)

A piece of string (about your body height)

Procedure:

1. Make your piece of string as wet as possible.
2. Put one cup (no water) on the ground and put part of the string in it.
3. Hold the other piece of string as high up as you can, and using the other cup, pour water down the string.
4. The water should be able to "travel" and "stick" to the string, conserving nearly all of the water.

Explanation:

Water's structure consists of 2 hydrogens and 1 oxygen, and due to the electrons on oxygen, makes water look like a Mickey Mouse hat from Disneyworld. The electrons also cause water to become polar, which means that each side of the atom is slightly charged. This charge makes water want to "stick" to each other, causing the properties of cohesion and adhesion. Cohesion is the property that water molecules like to "stick" to each other, again because of its polarity. Adhesion is the property where water molecules like to "stick" to other objects. These are two very important properties of water, and accounts for how plants can still take up water, despite how they're fighting against gravity.

Tips:

- Yarn is a great choice for string. Make sure you squeeze whatever string or yarn you have to help more water adhere to your string.
- Bring a towel just in case you splash some water.

Safety: Everything is relatively safe since you're using water. A towel will be helpful in clean up afterwards.

`

Pressure Differentials

Materials

1 Florence Flask with stopper and straw

10 mL Water

1 Plastic tub filled with water (enough to submerge)

1 Hot Plate

Utility Clamp

Setup

Add 10 mL of water to the Florence flask and place on hot plate to boil. Seal the flask with a stopper and straw sticking out of it so that fluid (air/water) can only enter through the straw. Fill the plastic tub with enough water to partially submerge the flask.

Procedure

Explain to kids that you need to fill up this flask but can't remove the stopper. Once the water in the flask is boiling, steam should be observed coming out of the straw. At this point, invert the flask and place immediately into the water as it cools. Fluid (water) from the plastic tub will fill into the flask due to the differences in pressure that was created by the temperature difference.

Explanation

The ideal gas law states that as temperature goes up, pressure goes up and volume goes up. When that air is heated, the molecules spread out really far because of the increase in pressure which essentially creates a great deal of empty space within the flask. When the flask is then removed from the heat, it cools which causes fluid to rush back into that empty space. We use water as the fluid because it is much easier to see than air.

Safety

The flask will be very hot when the water is boiled. Do not touch with bare skin until it has cooled. Also, the hot plate itself should be kept a safe distance away from flammable things and from students.

`

iffusion

Materials

Hot Plate

Ice

Three Beakers filled with ~100 mL water

Food Dye

Setup

Fill the 3 beakers up with equal parts water. Place one in an ice bath, one on a hot plate, and leave one at room temperature. The temperature of each beaker should be noticeably different to the touch.

Procedure

Place the 3 beakers next to each other on table in order of increasing temperature. Place

ample drops of food coloring in each beaker and observe the difference in rate of diffusion.

Explanation

Because of the increased kinetic energy within the hot liquid, diffusion takes place more rapidly. This is one reason that it is important for your body to stay within a small temperature range. Diffusion is when something moves from an area of high concentration to low concentration. This happens in countless body processes and also occurs across membranes.

Extension

Tonicity could also be demonstrated along with this. This could also be shown by placing a small potato slice in regular water and placing another potato in supersaturated salt water and leaving them sit for a little bit of time. The potato that is placed in the salt water will shrivel because the water that is inside the potato is moving across the membrane to an area of lower concentration.

`

Methylene Blue Redox Reactions

Karen Allnutt, Biology Major

Materials:

Clear plastic bottle
Methylene blue solution
Glucose solution
Sodium hydroxide solution
Oxygen in the bottle

Procedure:

1. Combine equal amounts of the glucose solution and sodium hydroxide solution in the clear plastic bottle.
2. Add 6-8 drops of the indicator methylene blue and put the cap back on the bottle.
3. Shake the bottle and observe.
4. Let the bottle sit for a few minutes and observe again.

Explanation:

This blue bottle experiment is a great tool for introducing reduction-oxidation reactions. An alkaline solution of glucose acts as a reducing agent and reduces added methylene blue from a blue to a colorless form. Shaking the solution raises the concentration of oxygen in the mixture and this oxidizes the methylene blue back to its blue form. When the dissolved oxygen has been consumed, the methylene blue is slowly reduced back to its colorless form by the remaining glucose.

$$HOCH_2(CHOH)_4CHO + 3OH^- \rightarrow HOCH_2(CHOH)_4CO_2 + 2H_2O + 2e$$

$$O_2 + \text{MB(Colorless)} \rightarrow \text{MBox (blue) (fast reaction)}$$

$$\text{MBox (blue)} + \text{CH} \rightarrow \text{MB (colorless)} + \text{Gluconic acid}^- \text{ (Slow Reaction)}$$

Where CH is the carbohydrate MB is the reduced (colorless) form of methylene blue, MBox is the oxidized (blue) form, and X- represents the oxidation products from glucose (gluconic acid).

Tips:

This experiment can be repeated multiple times. However, the solution is time sensitive so if this is to be used over the course of a few days, you will need to prepare new solutions each day. You could also change the concentrations of glucose and sodium hydroxide to have students compare the rates of reaction.

Safety:

Goggles and glasses should be worn by the teacher preparing the solutions. Make sure the cap of the bottle is on tight before shaking the bottle.

`

How to Light a Candle
Stephanie Clark, Biology Major

Materials:
Candle
Matches

Procedure:
1. Insure that the candle is burnt down enough so that the wax is melted around the wick
2. Use a snuffer to put out the flame of the candle so that the smoke trail is in a straight line up from the wick
3. Light another match and place the flame in the trail of smoke that is leaving the candle
4. Observe what happens to the wick of the candle

Tips:
The snuffer will work best to insure that the trail of smoke is straight up from the wick of the candle.

Explanation:
The trail of smoke leading up from the candlewick is vaporized wax. This means that by lighting the trail of that vapor, it should reignite the candle itself.

Safety:
When dealing with open flames it is extremely important to be cautious. Know where the fire extinguisher and fire blankets are or have one close to the lab station.

`

The Dancing Penny
Stephanie Clark, Biology Major

Materials:
One empty bottle with narrow neck
One large beaker or container for warm water
A penny or dime

Procedure:
1. Get the narrow opening of the bottle moist and then place the penny or dime on top of the opening
2. Fill the large beaker or container with water (it must be hot water but insure that it is not steaming or boiling)
3. Immerse the bottle into the water. Make sure that the penny is still on top of the bottle
4. Observe the results

Tips:
Fill the beaker or container with water before the demonstration. Also, make sure that the opening of the bottle is moist in order to create the seal.

Explanation:
Before covering the bottle with the penny, the bottle is filled with air. By wetting the opening of the bottle, a seal is created between the inside and outside of the bottle. Since the bottle is placed into hot water, the air inside of the bottle will heat and thus expand. In order for that expanded air to escape, it must lift the penny out of the way. The penny will fall back and recover the opening until more heated air needs to escape, which will cause the penny to rise up again. When this process occurs quickly, it causes a vibration effect of the coin.

Safety:
Handle hot water with care to avoid burns. Also, avoid spilling. If water is spilt, clean up quickly to avoid slipping.

`

Scared Pencil Shavings
Danielle Feil, Earth Science Major

Materials:
- Petri dish
- Water
- Dish soap
- Pencil shavings

Procedure:
1. Fill Petri dish about halfway with water
2. Place pencil shavings on the water all over
3. Place a drop of soap in the center of the dish
4. Observe and explain what is happening

Explanation:
Surface tension is highlighted in this demonstration. Surface tension refers to the cohesive properties forces between water molecules. The soap disrupts the surface molecules which lowers the surface tension causing the water molecules to spread out bringing the pencil shavings along with them showing the movement of the top layer of water molecules.

Tips:
- Make sure everyone can observe the pencil shavings
- Works the best with small pencil shavings or pepper

Safety:
- Make sure nothing is spilled especially with soap in the dish because it could cause slippery floors
- Pencil shavings are very small do not get in mouth or eyes

`

Hot and Cold Layers
Danielle Feil, Earth Science Major

Materials:
- Hot water in a small container
- Cold water in a small container
- Fish Bowl (or large clear bowl)
- Red food coloring in hot water
- Blue food coloring in cold water
- Jars with tin foil holders

Procedure:
1. Give viewers a chance to feel each cup to know one is cold and one is hot
2. Put food die in each cup to separate colors
3. Put room temperature water in the fish bowl
4. Put the jars with foil holders in fish bowl
5. Add cold container to the fish bowl first and place it in its holder
6. Add hot container to the fish bowl and place it in its holder
7. Observe the colors and then explain why

Tips:
- Practicing this would be helpful before presenting.
- Put cold in before hot.

Explanation:
This is a great visual for explaining how when fluids are heated, they become less dense and expand causing the hot red colored water to rise to the top. The cold dense, blue colored water will then sink showing the color difference. This also shows the visual of hot air rising and cold air sinks.

Safety:
- Hot and cold water need to be handled with care
- Pour gently to reduce spilling.

`

Balloon Skewer
Allison Hanlin, Biology Major

Materials:
Several latex balloons (9-inch size)
Bamboo cooking skewers (approximately 10 inches long)
Cooking oil

Procedure:
1. Inflate the balloon until it's nearly full size and then let about a third of the air out. Tie a knot in the end of the balloon.
2. Find the thick area of rubber at both ends of the balloon (where you tied the knot and the opposite end).
3. Soak the skewer in cooking oil.
4. Place the sharpened end on the skewer on the thick end of the balloon and carefully slide the skewer into the balloon.
5. Push the skewer all the way through the balloon until the tip of the skewer touches the opposite end of the balloon (the other thick portion of the balloon). Keep pushing until the skewer penetrates the rubber.

Explanation:
The latex in the balloon is made of long stands of molecules called polymers. The elasticity of these polymer chains causes the rubber to stretch when the balloon inflates. Because the most stretch occurs in the center of the balloon, the long chains of polymers are under much more stress than the chains at either end of the balloon. By piercing the balloon at the ends, where less stretch occurs, it allows the skewer to pass without popping the balloon. Safety: Be careful not to jab yourself or the balloon with the skewer. Also, know that it is possible for the balloon to pop while doing this experiment. Be prepared just in case this happens.

`

Temperature Dependent Reactions
Heath George Linville, Biology Major

Materials:
2 identical glow sticks
1 clear gallon container full of hot water
1 clear gallon container of ice water

Procedure:
1. Break both glow sticks so the audience can see them both glowing the same.
2. Drop one glow stick into the hot water
3. Drop one glow stick into the ice water
4. Observe the change in how much light emanates from the jars.

Tips:
If the room is large use several glow sticks in each jar to improve the observability of temperature's effect on the chemical reaction.

Explanation:
This demonstration shows that the chemical reaction that makes the glow stick produce light is temperature dependent. The reaction is sped up by a high temperature and slowed by a cold temperature. The light is a visible display of how molecular motion is measured by temperature.

Safety:
Make sure the jars are on a stable platform or table to make sure they do not fall and break. Clean up any fluid that leaks from a glow stick immediately; it is not safe to consume.

`

Sodium Acetate Supersaturated Liquid
Gwendolyn McIrvin, Chemistry Major

Materials:
175g of $NaC_2H_3O_2\ 3H_2O$ (sodium acetate)
50mL water
Hot plate
Stir rod
Crystallizing dish
250 mL beaker
Spatula

Procedure:
PRE-DEMONSTRATION

1. Add the sodium acetate to the water in the 250mL beaker.
2. Heat the beaker with a hot plate on a medium setting.
3. When all the crystals have dissolved into solution, turn off heat and allow to cool (this may take several hours).

**Note: The Chemistry department has pre-made Sodium Acetate solutions. Therefore, you may not have to make the solution from scratch.

DEMONSTRATION

4. Place a few sodium acetate granules in the bottom of the crystallizing dish.
5. Carefully pour the cooled solution over the granules to make crystallized structures. The solid formed will be white, solid, and very hot.
6. Use a spatula to cut the crystallized sculptures into smaller pieces to return to the main container. 7. This solution can be stored and reused. Simply store as a solid in a covered beaker and re-melt for the next demonstration.

Explanation:
Normally, only a certain amount of solute can be dissolved in water (saturated solution). When the water is heated, more solute can be dissolved and the solution becomes "supersaturated" when cooled. Such is the case here. A large amount of sodium acetate is dissolved in warm water and then cooled. When agitated or poured over solid acetate granules, the rest of the solution will immediately crystallize.

Tips:
• This is a very touchy demonstration. The solution will crystallize if there are any solid crystals remaining on the rim of the beaker.

Safety:
• Goggles must be worn at all times.
• Use caution when handling hot glassware
• This is a very exothermic reaction. Therefore, the crystals that from will be very warm. Avoid touching them.
• Solution can be recycled and used several times. Simply heat the crystals gradually until dissolved and let cool for a few hours.
• Should the solid crystals need to be disposed of, just wash down drain with water.

`

Lava Lamp Density Demonstration
Lindsey Passantino, Post Bac- Biology

Materials:

Clear container
Water
Vegetable oil
Alka-Seltzer tablets
Funnel
Food coloring

Procedure:

1. To create the system, fill the container ¼ of the way with water.
2. Use the funnel to fill the container the rest of the way with vegetable oil.
3. Add 10 drops of food coloring to the mixture.
4. Wait for oil and water to separate. (Brief discussion of oil and water densities/properties could be inserted here.)
5. After the two layers separate, add two broken Alka-Seltzer tablets into the container. 6. Watch as the bubbles rise and fall.

Explanation:

Oil floats on water because a drop of oil is lighter than a drop of water the same size. Another way of telling students this is to say that water is more dense than the oil. Density is a measurement of how much a given volume of something weighs. Items that are less dense than water will float in water. Items that are more dense than water will sink. These two substances do not mix together because oil is non-polar and is hydrophobic. When you drop the Alka-Seltzer tablet into the solution, the citric acid and sodium bicarbonate react in the water, causing the release of carbon dioxide. The carbon dioxide bubbles rise to the top, pulling the water/food coloring with them. When the bubbles reach the top of the container, the carbon dioxide releases into the air and the colored water sinks back down to the bottom of the container. This is because the colored water's density is greater than the oil's.

Safety:

Watch out for spills.

`

Slime
Kayla Schinke, Biology

Materials:
1/4 cup of water
1/4 cup of white craft glue
1/4 cup of liquid starch
Food coloring (optional)
Mixing bowl
Mixing spoon

Procedure:
1. Pour all of the glue into the mixing bowl.
2. Pour all of the water to the mixing bowl with the glue.
3. Stir the glue and water together.
4. Add your food color now - about 6 drops should do it.
5. Now add the liquid starch and stir it in.
6. It should be nice and blobby by now. As you play with your slimy concoction, it will become more stretchy and easier to hold.
7. Explore your slimy creation and store it in a zip bag when you are not using it.

Explanation:
The glue is a liquid polymer. This means that the tiny molecules in the glue are in strands like a chain. When you add the liquid starch, the strands of the polymer glue hold together, giving it its slimy feel. The starch acts as a cross-linker that links all the polymer strands together.

Safety:
The water, liquid starch, and glue should be used for lab purposes only. The food coloring will dye clothing and skin.

`

Ice/String Magic
Paige Taylor Biology UNC

MATERIALS:
1 large ice cube
1 piece of thin string
NaCl (table salt)
Plate
Cup of water

PROCDURE:
1. Place the large ice cube on the plate
2. Dip the string into the cup of water (ensure one inch of string is wet)
3. Lay the wet part of the string on top of the ice cube
4. Place a good portion of salt over the string, making sure to cover all of the string that is touching the ice cube.
5. Wait 20 seconds 6. Pick the string up and the ice cube should be attached to the string

EXPLANATION:
NaCl (table salt) lowers the melting point of water. When salt is placed on the ice it causes the melting point of the ice to lower slightly. This lets the string that was placed on the top of the ice cube to sink into the ice cube slightly. The water then re-freezes itself around the string pretty quickly. The ice cube then lifts up with the string. In winter salt is sprinkled on the street in order to keep the ice from forming (the salt lowers the melting point of the ice and it doesn't ice up the streets) and to also cause the ice to melt.

`

Burn Paper with Ice
Danny Thistle, Physics

Materials:
Sodium peroxide – Na_2O_2
Easily combustible material (tissue paper, sawdust, starch)
Small ice chips
Fire proof surface
Fire extinguisher

Procedure:
1. With some showman ship pose the question, can ice be used to burn this tissue paper?
2. Shred and pile the tissue on top of the fire proof surface (5cm in height)
3. Place ½ teaspoon sodium peroxide on top of the tissue paper
4. Showing the kids you are just adding the ice chip, place it on top of the tissue paper and sodium peroxide
5. Stand back and observe the reaction

Explanation:
The reactants create an exothermic reaction (energy exits the system) that releases enough energy to ignite the tissue paper. The tissue paper is just a fuel source once the flame is lit. It is not a component of the reaction.

Safety:
The reaction happens between sodium peroxide and water, so the two must be kept separate. Fire must be contained to the fire proof surface.

`

Carbon Dioxide
Bubble Amy Ordaz, Biology Major

Materials:
Block of dry ice
Bowl of water
Liquid dish soap
Rag

Procedure:
1. Soak the rag with some dish soap and water
2. Place the block of dry ice into the bowl of water
3. When the ice begins sublimate, take the rag and slide it across the lip of the bowl
4. This should create a large bubble of carbon dioxide, from the dry ice

Tips:
Place apparatus on a towel to avoid a mess

Explanation:
Dry ice is frozen carbon dioxide that will change directly from solid to a gas, a process known as sublimation. The dish soap and water will create a thin layer over the top of the sublimating dry ice, and this will consequently create a bubble. When the bubble is popped, all that is released is simply the carbon dioxide gas that has built up inside the bubble.

Safety:
Dry ice should be handled carefully, as it is very cold.

`

Burn Paper with Ice
Lucas Owens UNC Physics

MATERIALS:
Sodium peroxide
Finely chopped tissue paper, or sawdust, or starch.
A small chip of ice.

PROCEDURE:
1. Before doing anything, show students a piece of tissue paper and ask: Would I be able to burn this piece of tissue paper with ice?"
2. Tear or cut tissue paper into very fine pieces and place them in a heap on a fire proof surface and build it up to a cone which is about 5 cm high in the center.
3. On top of the cone, place a half teaspoon of sodium peroxide.
4. Now show the students the small chip of ice and put it on top of the heap stand back and observe.

EXPLANATION:
$Na2O2 + H2O \longrightarrow 2NaOH + On + energy(heat)$
The exothermic reaction above releases enough energy to ignite the paper.

SAFETY:
Be careful to keep the flame contained on the fireproof surface. Sodium reacts with water so the reaction can occur accidentally.

`

Burning Chemicals

Kai Ficek, Physics Senior

WARNING! In recent years this lab has resulted in several tragic accidents and lawsuits. To make the lab safer a couple of precautions can be taken.

1.) **Put the salts on filter paper and place them on a ceramic surface (or other heat resistant surface) and set the paper on fire. The color of the salt flames will be clear.**
2.) **Have a Bunsen burner and copper wire. Get the wire hot in the Bunsen burner (it burns green), then place it in some salt (so it sticks), then put the salty wire in the flame. It will burn the color of the sat for a couple of seconds.**
3.) **Soak wooden skewers in salt water (a different skewer for each salt) overnight. Then burn the skewer.**

Materials:
- Variety of chemicals with chloride salts: $SrCl_2$, $NaCl$, KCl, $CuCl_2$, $LiCl$, $CaCl_2$
- Ethanol
- Glass Petri Dishes, one per chemical

Setup and Procedure:

Mix amounts of each chemical individually with ethanol in glass petri dishes. Light each one on fire and notice how they all burn at different colors. Discuss the different chemicals in relation to their colors.

Explanation:

Elements are fundamentally different from each other and that's what we observe when they burn. Each element has a different structure and it's the number and layers of electrons that determine which colors we see when they burn. The differences are at the level of every single atom that is present in the chemicals we are burning.

Safety:

Always use caution with fire. The ethanol is very flammable and should be used with care. The chemicals may be caustic, use gloves any time there's any interaction with chemicals. Safety glasses and gloves are a good idea for this demonstration.

`

CO2 Bubble
Kai Ficek, Physics Senior

Materials:
- Long, narrow strips of fabric (from an old t-shirt)
- Dishsoap such as Dawn or Ajax
- Bowl and cup, or two cups
- Water
- Dry ice, approximately ½ pound

Setup:
Place a good amount of soap in a little bit of water and submerge the strips of fabric in the solution. Pour the pure water into the other bowl or cup.

Procedure:
Place dry ice in the bowl or cup with water. Rub the soapy fabric strips around the rim of the bowl or cup. Next, scrape the fabric strips across the rim to form a bubble across the surface.

Explanation:
This experiment shows two different aspects of phases of matter. First, it shows sublimation, the process by which a solid turns directly into a gas without first becoming a liquid. The second idea is it shows how gasses behave under pressure. As more gas is created it expands to fill the bubble.

Safety:
Wear gloves when handling dry ice as it will burn skin on contact.

`

Combustion Reaction: Candle in a Jar
Sara Heidel- Earth Science Senior

Materials:
1 small candle
1 glass jar and lid, large enough for the candle to fit
Long matches or lighter

Procedure:
1. Place the candle upright in the jar
2. Light the candle
3. Screw the lid onto the jar tightly; watch as the candle is extinguished

Explanation:
As the candle burns, a combustion reaction occurs. One of the products of combustion is water; you might have noticed water condensing on the inside of the jar. Once the flame has consumed all of the oxygen in the jar, it can no longer be fueled and is extinguished.

Safety:
Use caution when handling the jar and lid, they may be hot.

`

Make Flubber
Sara Heidel- Earth Science Senior

Materials:
Warm water
3 tsp. Borax
2 cups of white glue
Food coloring

Procedure:
1. In a large container, combine 1.5 cups warm water, 2 cups white glue and food coloring
2. In a second, smaller container, combine 3 2/3 cups warm water with 3 tsp. of Borax
3. Mix ingredients in each container thoroughly
4. Pour contents of smaller container into large container
5. Gently lift and turn the mixture until approx. a tablespoon of liquid is left

Explanation:
Flubber is a polymer. The word polymer comes from the Greek language from poly “many” and meros “parts”. Polymers are large molecules consisting of repeating identical structural units connected by covalent chemical bonds. Polymers can be naturally occurring or manmade. Manmade polymers are materials like nylon, polyester, and polystyrene. Examples of naturally occurring polymers are proteins in our body like tubulin and actin. These proteins make up microtubules and microfilaments that serve as structural components within our cells.

Safety:
Do not ingest this material.

`

B Squared (Burning Balloons)
Dene Gallagher, Biology Major

Purpose:
Show the different properties of dispersing heat through different mediums.

Materials:
-One balloon filled with water
-One balloon filled with air to an equal volume
-matches

Procedure:
Light a match and hold it under the air filled balloon. Prepare for it to pop immediately. Now, hold a match under the balloon that is filled with water, the balloon shouldn't pop. Don't hold the match in one spot, hold it close, but move it slowly beneath the balloon.

Concept:
The balloon filled with the air pops right away because the match burns quickly through the rubber of the balloon and the air did not absorb the heat. The water balloon didn't pop because the water, not only dispersed the heat, it absorbed it as well. Also, air has a lower specific heat capacity than water does, meaning that less heat is needed to warm up the air, not a lot of energy in required to increase the kinetic energy of the gas molecules, whereas water takes a lot of energy to heat up the water and increase the kinetic energy of its molecules.

`

Swelling Syringes
Dene Gallagher, Biology Major

Materials:
-plastic syringe
-multiple marshmallows (possibly colored so they are more visible)

Procedure:

1. Put the marshmallow in the barrel of the syringe
2. Cover the tip of they syringe with your finger during the demo
3. Pull they syringe back and observe the effect on the marshmallow
4. Now, plunge the syringe forward and observe the effect on the marshmallow

Follow up questions:

1. What is being compressed, the air or the marshmallow?

Concept:
When the plunger is pulled back on the syringe the air pressure in the barrel of the syringe is decreased; you are allowing the air molecules more space to move, so the air in the marshmallow moves out and causes the marshmallow to grow in size. When the plunger is pushed in the air pressure increases, thus compressing the marshmallow. Boyle's Law states P1V1=PV2, so the measurements are related. You can envision P and V on either side of a see-saw, when one goes up the other goes down.

`

Natural Acid and Base Indicators
Dene Gallagher, Biology Major

Materials:
-1.5 ml diluted blueberry juice
-Vinegar
-Ammonia
-3 100 ml beakers

Procedure:
-Add small amount of ammonia to diluted juice
-observe color change
-add vinegar and the solution will turn back to the blue color

Concept:
Acids contain a lot of H+ ions, while bases contain very few. The juice is an indicator, that for some reason is sensitive to the amount of H+ in a solution. When there are a lot of H+ ions the indicator turns green, showing an acidic solution. When there are only a few H+ ions the indicator turns a different color. Ammonia is a base and when it is added to the blueberry juice it turns deep green, showing the presence of a base. The blueberry juice is an indicator, so the color won't change when an acid, vinegar, is added. Then if vinegar is added to the ammonia/juice mixture, it will make it more basic, thus turning it back to blue.

`

Bubbling Lava Lamp
Shelby Hojio-Ratzlaff - Biology Senior

MATERIALS:
Clean, plastic bottle, glass, jar, or test tube
Vegetable oil
Food coloring
Water
Alka-Seltzer
Flashlight

PROCEDURE:
1. Fill the bottle ¼ of the way with water
2. Fill the rest of the bottle with vegetable oil
3. Add 10 to 20 drops of food coloring
4. Drop alka-seltzer tablets into the bottle
5. To make the lava lamp more Lava-like, turn the lights down and put your bottle over a flashlight

TIPS:
You can continue adding alka-seltzer as many times as you like.

EXPLANATION:
Oil and water do not mix and oil is less dense than water. The alka-seltzer tablets react with the water to make bubbles of carbon dioxide gas. The bubbles attach to colored water and float to the surface.

SAFETY:
When you drop the alka-seltzer tablets into the oil, be careful that no splatters of oil go into your eyes.

`

Dissolving Styrofoam
Shelby Hojio-Ratzlaff - Biology Senior

Note: In this lab, the Styrofoam is no dissolved, it is degassed. If the Styrofoam were to dissolve there would be so 'slime' left over. If it were to dissolve it would become part of the liquid.

MATERIALS:
Tin pie pan Styrofoam cup acetone

PROCEDURE:
1. Fill the pie pan ¼ full with acetone
2. Place the Styrofoam cup in the acetone
3. Observe the Cup melt like the Wicked Witch from The Wizard of Oz

EXPLANATION:
Styrofoam is a polymer made from styrene. A polymer is made up of long chains that intertwine with each other. Alone, polystyrene is a hard plastic, to create soft Styrofoam, gas is bubbled through it as it polymerizes. When the cup is placed in acetone, the acetone serves as a lubricant between the polymer chains, this allows them to slide around each other, becoming a soft blob in the acetone. When the blob is removed and the acetone is allowed to evaporate it solidifies into hard plastic.

SAFETY:
Safety should be exercised when using acetone so as not to splatter in eyes.

`

Effects of temperature on chemical luminescence
Casey McGaughey-Earth Science Senior

MATERIALS:
Two chemical light sticks Ice water in a container Hot water in a container

SETUP:
You will need clear containers to hold hot and ice water while allowing the light sticks to be visible.

PROCEDURE:
Break the internal ampule of the light sticks; insert one in the ice water and the other in the hot water. Compare the glow of each given the temperature difference of the water the light in the warmer water should be much brighter than the light in ice water, due to the speed of the reaction occurring within each light stick.

TIPS:
Ensure a fairly large difference in water temperature.

EXPLANATION:
The light produced by the light stick is the result of a chemical reaction; temperature affects the speed at which a chemical reaction takes place. The hot water will speed the reaction up producing a brighter light than the ice water. If left long enough to complete the reaction and stop illuminating it would be found that the light in the ice water lit for much longer than the light in hot water.

SAFETY:
There are none as long as hot water is used to heat the light and not a microwave or boiling water.

`

CO2 Bubble
Laura Pedersen – Earth Science Senior

MATERIALS:

1. Old T-shirt cut into long narrow strips
2. Liquid Dish Soap (like dawn)
3. Cup
4. Water
5. Large Bowl
6. Dry Ice (~ 1/2 pound)

SETUP:

1. Put large concentration of soap and water in cup
2. Submerge the strips of T-shirt into dish soap mixture
3. Fill the large bowl with water

PROCEDURE:

1. Place the dry ice into the bowl of water
2. Glaze the rim of the bowl with soapy T-shirt
3. Scrape the rim of the bowl with the T-shirt

TIPS:

1. Try not to get any soapy water into the bowl, for it will make the bubble pop more often.
2. Scraping the T-shirt slowly, rather than fast, will help make the bubble stay on the bowl.
3. This can be done on a smaller scale as well; using cups instead of bowls.

EXPLANATION:

This demonstration is showing the process of sublimation in a more creative way. Sublimation is the process of transformation directly from the solid phase to the gas phase without passing through an intermediate liquid phase. Sublimation is an exothermic process that occurs at temperatures and pressures below a substance's triple point in its phase diagram. Additionally, this demonstration can represent what happens when gases remain under pressure; which is demonstrated as the gas builds up under the soapy film and continues to expand until it pops.

SAFETY:

1. Dry ice can burn skin - Use gloves whenever handling dry ice.
2. Never put dry ice into closed container

`

Holy Water
Abby Lundien – Earth Sciences Senior

MATERIALS:

- Clear Glass
- Water
- Powdered Sugar

PROCEDURE:

- Fill a glass until it is overflowing with water and the full amount remains over the lip of the glass.
- Slowly sprinkle powdered sugar on top of the water, taking care to not overflow the glass.

EXPLANATION:

This demonstration is to show the space between molecules. By adding powdered sugar to a glass of water that appears to be full, and it not overflowing, it demonstrates that there is still room in the glass, which is in between the molecules.

`

Egg in a Bottle: Pressure Differentials
Alice Arbogast

MATERIALS:
1 glass bottle (old milk bottle, Erlenmeyer flask etc)
1 hard-boiled egg Match or lighter Paper (to burn; newspaper works well)

SETUP:
Make sure there is fire extinguishing equipment nearby as a safety precaution.

PROCEDURE:
Place the egg on the opening of the bottle to show that it does not fall through and would not easily be pushed through. Remove the egg, then use your match or lighter to light the paper on fire and drop it in the bottle. Quickly replace the egg on the bottle opening. The egg will fall into the bottle.

TIPS:
Make sure the size of egg you buy is suitable for the container you are using. Let the flame burn for a second or two before you put it in the bottle

EXPLANATION:
When you place the lit paper in the bottle, the air inside the bottle heats up and expands. When the flame goes out, the air inside the bottle begins to cool. As it does so it contracts, or reduces in volume. This lowers the pressure of the air inside the bottle. The pressure differential between the outside atmosphere and the inside of the bottle causes the egg to fall into the bottle.

SAFETY:
A fire extinguisher should be present in any experiment involving fire.

`

Hot Pack
Amy Bekins – Chemistry Post Bac

MATERIALS:
Vinegar
Steel Wool
Ziploc Bags

PROCEDURE:
1. Put steel wool in the Ziploc bag
2. Add Vinegar.
3. Shut bag and enjoy the heat.

TIPS:
Do not get watered down vinegar. Make sure that you do not get a thin bag, needs to be thick enough so the steel wool does not cut through the bag.

EXPLANATION:
Steel wool and vinegar create a chemical reaction that is exothermic. Thus producing an observable heat, and creating the heat associated with a hot pack.

SAFETY:
Steel wool can cut you

`

Dissolving Chalk
Amy Bekins- Chemistry Post- Bac

MATERIALS:
Something for the reaction to occur in (a cup or a Ziploc bag)
Vinegar
Lemon
Juice
Chalk

PROCEDURE:
1. Place chalk in the container where you want the reaction to occur.
2. Put in enough lemon juice to cover part of the chalk.
3. Put in enough vinegar to completely submerge the chalk
4. Watch reaction occur.

TIPS:
The chalk may not fully dissolve this does not mean the reaction isn't occurring. You will still hear sizzling and see bubbles. If you have a small class you might be able to pass it around and let them see.

EXPLANATION:
The vinegar and the lemon juice react with the chalk to dissolve the components of the chalk. You can use this to talk about chemical reactions for the chemical reaction is easy to see. You can also use it to show the production of a gas because a gas is being produced.

`

The Incredible, Transforming Liquid Served at the School Dance
Keri Bowling – Post-baccalaureate Teaching Candidate – Secondary Science

MATERIALS:

Opaque pitcher or extra-large opaque cup
4 clear cups
Phenolphthalein
Water
Vinegar (acid)
Ammonia, Sodium hydroxide or milk of magnesia (base)

SETUP:

1. In the pitcher, mix 2 Tablespoons of Phenolphthalein into ½ gallon of water.
2. Line up all four cups in front of you
    a. leave the first cup empty
    b. put a few drops of ammonia in the 2nd and 3rd cups
    c. put a teaspoon of vinegar in the 4th cup

PROCEDURE:

1. As you pour the phenolphthalein-water mixture into the first cup, you explain that you are serving free drinks at the school dance and the first student that comes up to the drink station wants water. (liquid in cup is clear)
2. As you pour the phenolphthalein-water mixture into the second cup, you explain that the second student decides to order strawberry juice. (liquid in cup is pink)
3. As you pour the phenolphthalein-water mixture into the third cup, you explain that the third student saw how delicious the strawberry cool-aid looked, and also ordered strawberry cool-aid. . (liquid in cup is pink)
4. The next student that comes to the drink station started to order and then the DJ starts to play their favorite song and the student quickly leaves to go dance without ordering anything! (looks like the cup is empty)
5. The first three students come back to the drink station and say that they would all like strawberry juice this time, so you pour the three cups back into the pitcher and re-pour the phenolphthalein-water mixture into all three of the cups. (Liquid in all three cups is pink)
6. Finally, after their song is over, the fourth student comes back to the drink station and orders water. So, you pour the phenolphthalein-water mixture into the fourth cup. Pour slowly so the audience can see that a pink liquid is coming from the pitcher, but the liquid turns clear once it enters the cup!

EXPLANATION:

Phenolphthalein is an indicator of acids (in this case vinegar), which will become or stay colorless, and bases (in this case ammonia), which will become pink when it comes into contact with phenolphthalein. When Phenolphthalein is added to water, the mixture is clear because the pH is neutral. When Phenolphthalein and water are added to ammonia, the hydroxide ions increase and the hydrogen ions decrease, pH increases and the mixture turns pink. When Phenolphthalein and water are added to vinegar the hydrogen ions increase and the hydroxide ions decrease, pH decreases and the mixture turns clear.

SAFETY:

All mixtures in this lab are not safe to drink.

`

Eggshell Fire Extinguisher
Keri Bowling – Post-baccalaureate Teaching Candidate – Secondary Science

MATERIALS:
Eggshell
Vinegar
Deep container (beaker works well)
Candle
Candle holder – can be a bowl with sand to hold the candle upright
Matches

PROCEDURE:
1. Put 3 teaspoons of vinegar in a deep container (beaker)
2. Place small pieces of eggshell into the beaker
3. Light the candle (completing this step here will allow the gas from the vinegar and eggshell to build up)
4. Pour the gas (NOT the liquid) from the beaker onto the lit candle
5. The flame on the candle will go out

EXPLANATION:
The acetic acid in vinegar reacts with the calcium carbonate in the eggshell, making carbon dioxide gas. The carbon dioxide gas smoothers the fire and extinguishes the flame.

SAFETY:
Use caution with matches and the lit candle. Make sure to tie back long hair and keep all items out of the reach of the flame from the candle.

`

Effects of Pressure on Volume- Boyle's Law
Shawn Murphy – Biology Postbac

MATERIALS:
Pressure pot
SCUBA air cylinder
SCUBA regulator
Balloon
Styrofoam cup

SETUP:
A pressure pot is a device that is used by dive shops to simulate the pressure at depth underwater for testing dive gauges and other equipment. A SCUBA cylinder and regulator are attached to the pressure pot to apply pressure. A balloon or Styrofoam cup can be placed inside the device.

PROCEDURE:
When an inflated balloon is placed inside the pressure pot and the pressure is increased, the volume of the balloon will begin to decrease. The more pressure that is applied, the smaller the volume of the balloon will become. When the pressure is lowered the balloon will revert to its original size. When a Styrofoam cup is placed in the device and pressure is applied, the air spaces in the cup will be decreases in a similar fashion to what occurred in the balloon but when the pressure is decreased, the cup will not revert to its original size and will appear much smaller.

TIPS:
This demo takes some time to setup and should be done prior to any teaching activity.

EXPLANATION:
The demonstration shows the inverse relationship between pressure and volume. As the pressure is increased to 2 ATMs, the volume of the balloon will be decreased by one half of the original volume. As the pressure is increased to 3 ATMs, the volume will be decreased by 1/3 of the original volume. As the pressure is increased to 4 ATMs, the volume will be decreased by 1/4 of its original volume. This relationship is demonstrated in the Boyle's Law equation, PV=nRT. As pressure increases on a gas, the volume must decrease when the temperature is held constant.

SAFETY:
Proper training on the pressure pot is necessary prior to use.

`

Halocline
Shawn Murphy – Biology Postbac

MATERIALS:
Salt
Water
Food coloring
Clear glass

SETUP:
Three tablespoons of salt is placed into 16 ounces of water and stirred until dissolved food coloring is added to this mixture. A different food coloring is added to 16 ounces of fresh water.

PROCEDURE:
The salt water mixture is first placed into a clear glass, filling it half way. The fresh water mixture is then slowing placed in the glass by pouring it down the side of the glass to prevent the two solutions from mixing. The two mixtures will layer in the glass with the salt water mixture on top.

TIPS:
Warmer fresh water can help keep these solutions from mixing but this is cheating a little. The salt water solution can be super saturated by heating a larger amount of salt and water and then cooling it.

EXPLANATION:
The demonstration shows how different densities of water will layer. The salt water is more dense, layers on the bottom. This is seen where fresh water rivers empty into the ocean. A clear halocline is seen in these areas as the water layers. This is also an issue in coastal areas where the water table is being depleted and salt water from the ocean seeps in.

SAFETY:
None

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Shell Be Gone!
Benito D. Espinoza

MATERIALS:

- a few eggs
- white vinegar
- a container big enough to hold all your eggs and a cover for the container
- a big spoon

PROCEDURE:

1. Place your eggs in the container so that they are not touching.
2. Add enough vinegar to cover the eggs. Notice that bubbles form on the eggs. Cover the container, put it in the refrigerator, and let the eggs sit in the vinegar for 24 hours.
3. Use your big spoon to scoop the eggs out of the vinegar. Be careful—since the eggshell has been dissolving, the egg membrane may be the only thing holding the egg together. The membrane is not as durable as the shell.
4. Carefully dump out the vinegar. Put the eggs back in the container and cover them with fresh vinegar. Leave the eggs in the refrigerator for another 24 hours.
5. Scoop the eggs out again and rinse them carefully. If any of the membranes have broken, letting the egg ooze out, throw those eggs away.
6. When you're done, you'll have an egg without a shell. It looks like an egg, but it's translucent—and the membrane flexes when you squeeze it.

EXPLANATION:

When you submerge an egg in vinegar, the shell dissolves. Vinegar contains acetic acid, which breaks apart the solid calcium carbonate crystals that make up the eggshell into their calcium and carbonate parts. The calcium ions float free (calcium ions are atoms that are missing electrons), while the carbonate goes to make carbon dioxide—the bubbles that you see. (http://www.exploratorium.edu/cooking/eggs/activity-naked.html)

`

Oscillating Iodine Clock Reaction

Eric Leeper- Earth Science Secondary education

MATERIALS:

3 test tubes- pre-measured
Erlenmeyer flask with rubber top
Goggles
Hot plate- if you want to make it go faster
Small graduated cylinder
Large graduated cylinder
Chemicals:

Solution 1: 3.6 M hydrogen peroxide. To get this dilute 204 mL 30% hydrogen peroxide to 500 mL water.

Solution 2: .2 M Potassium Iodate, .16 M Perchloric acid, To get this dissolve 21.4 g of potassium Iodate in about 400 mL of hot water, then get 11.2 mL of 70% Perchloric acid and dilute to 500 L with water to complete the second solution.

Solution 3: .15 M malonic acid, .04 M Manganese sulfate, .04% starch, To get this dissolve .2 g of soluble starch in 100 mL of boiling water, let cool for 10 minutes off of the hot plate then put back on the hot plate and add 15.6 g malonic acid and 3.4 g of Manganese sulfate monohydrate, diluted to 500 mL.

PROCEDURE:

Get equal amounts of each solution 1, 2, 3 and place into one large graduated cylinder and observe what happens.

TIPS:

Concentrations must be fairly equal for reaction to work.

EXPLANATION:

In the demonstration once the solutions are mixed the unstable chemical reaction will continuously change colors between clear, blue and gold. The specific principle is the difference between a chemical and a physical change.

SAFETY:

Lab attire: Close toed shoes, pants, goggles, gloves and apron. 30% Hydrogen peroxide-Eye contact: Immediately flush the eye with plenty of water. Continue for at least ten minutes and call for medical help without delay. Skin contact: Wash off with plenty of water. Remove any contaminated clothing. If the skin reddens or appears damaged, call for medical aid. If swallowed: Wash out the mouth with water if the person is conscious; call for immediate medical help. Potassium iodate-Harmful if swallowed. May be harmful by inhalation or through skin absorption, Irritant. Perchloric acid- It is highly corrosive to all tissues and reacts violently with many oxidizable substances. Fire/explosive hazard if shocked. Malonic acid-Harmful if swallowed, inhaled or absorbed through the skin. Manganese sulfate- Manganese sulfate is harmful if you swallow or inhale it, and may be harmful in contact with the skin.

`

50 Plus 50 Doesn't Always equal 100, Water vs. Alcohol
Eric Leeper, Earth Science- Secondary Education

MATERIALS:
Water
91% Isopropyl Alcohol
2 test tubes- pre- measured
Burette
2 graduated cylinders
Erlenmeyer flask
Metal stand plus clamps
Funnel

SETUP:
Metal stand will be on the table with clamps on it that will hold the burette up in the air.

PROCEDURE:
First 100 mL of water is poured into the burette and marked, then poured out. Then, Equal amounts of 50 mL water and 50 mL of alcohol will be poured into the burette.

TIPS:
Higher the concentration of isopropyl alcohol the better- it contains less water

EXPLANATION:
There is an active rearranging of molecules that are attracted to one another that result in the final volume change. This is great when discussing volumes and specific formulas for compounds.

SAFETY:
Goggles must be worn Isopropyl alcohol- Can irritate skin, should not be drank, very flammable, evaporates quickly producing noxious fumes, if spilt clean immediately.

`

Density Column
Alicyn Roberson - Chemistry Senior

MATERIALS:

Honey
Pancake Syrup or corn syrup
Liquid Dishwashing Soap
Water (with food coloring)
Vegetable Oil
Rubbing Alcohol (with food coloring)
Container to pour all materials
Spoon
Containers to mix the food coloring and materials

PROCEDURE:

1. For timing purposes: a. Mix the substances with food coloring in a separate container before class.
2. Carefully pour the liquids over the back of the spoon into the clear container from most dense to least dense. The most dense is honey and the least dense is rubbing alcohol. The order given in the materials is from most dense to least dense. (See Figure 1.1)

TIPS:

1. Substances must be poured from most dense to least dense
2. Avoid the sides of the container and pour slowly so the substances do not mix
3. Pour the less viscous liquids slower and closer to the other substances

EXPLANATION:

The density column allows the students to see density with many different household items. Using the demonstration, many Chemistry vocabulary terms can be brought in. Some of the substances have a high viscosity. The more viscous solutions fall to the bottom due to density. Emulsion occurs when two or more substances mixed together without mixing together. This occurs often in the density column when the rubbing alcohol is added. It created emulsion with the vegetable oil Figure 1.2.

SAFETY:

The rubbing alcohol is highly flammable and also has a noticeable smell that is overpowering, use only in a ventilated area.

`

Boyle's Law
Alicyn Roberson - Chemistry Senior

MATERIALS:
Two Plastic Gallon Jugs
Two Regular Balloons
Scissors or sharp knife

SETUP:
1. Cut a hole in the bottom or side of one container. (1 inch by 2 inches is fine)
2. Place one balloon into the neck of the gallon jug and stretch the balloon over the mouth of the jug.(Figure 1.1)

PROCEDURE:
1. Try to blow up the balloon in the jug without the hole in the side.
2. Try to blow up the balloon in the jug with the hole in the side.
3. Discuss the properties of gas and pressure related to volume.

TIPS:
1. For timing, having the balloon already in place will limit the time necessary for the demonstration.

EXPLANATION:
Boyle's Law states that $P_1V_1=P_2V_2$, where P is pressure and V is volume. In this demonstration, the air inside the plastic jug cannot expand outside the bounds of the containers flexibility. Once the capacity for air pressure is reached, the balloon will cease inflating and will force air out of the balloon. When there is a hole in the side of the plastic jug, the gas in the plastic jug continues to exit as air enters the balloon and the balloon will fill until it cannot expand anymore.

SAFETY:
Watch for students with latex allergies. Scissors and knife will be sharp, exercise caution when cutting the plastic jug.

`

Sinking Eggs
Alicyn Roberson - Chemistry Senior

MATERIALS:
Two raw eggs
Two clear glasses/ plastic cups
Salt
Water
Food coloring if desired

SETUP:
1. Pour water into both cups until it is 2/3 full.
2. Stir salt into one cup until it is saturated (I found that in about 1 cup of water, I needed about a half cup of salt to saturate the solution).
3. Add food coloring if desired.

PROCEDURE:
1. Add one raw egg to the cup with only water.
2. Demonstrate that it sinks and explain density.
3. Add the other raw egg to the cup with water and salt.
4. Explain why the egg floats.

TIPS:
1. Test this to make sure the egg will float in your container and with the right amount of salt

EXPLANATION:
The density of a raw egg is slightly higher than water, which is why it sinks in water. The salt raises the density of the water and the egg will float on the water. Research has shown that an average egg has an approximate density of 1.06 g/mL and the density of 25% salt water is 1.25 g/mL. Using this knowledge, the density of the egg is less than the density of salt and will therefore float in salt water.

SAFETY:
Spoiled eggs may smell and have a slightly lower density than fresher eggs

`

Water on a Penny
Brianne Wold – Biology Major

MATERIALS:
Penny
Dropper
Water supply
Soapy water (or ethanol)
Paper towel

SETUP:
Set up the penny and water supply on a paper towel, possibly on a document cam so that the whole class can see what is happening.

PROCEDURE:
Drop water onto a penny one drop at a time. Do not touch the water on the penny with the dropper.

Count how many drops fit on it.

Do the same thing with soapy water. You should get a lower number of drops.

EXPLANATION:
The number of drops that fit on the penny before the bubble breaks should be higher than compared to the soapy water or ethanol because they do not have the same properties as water. Adhesion, cohesion, surface tension, and hydrogen bonding adds to the higher number of drops that fit on the penny.

SAFETY:
If you use a doc cam, be aware that you are using water around electricity. Ethanol might also be used and can injury your eyes if there is contact.

`

Acids and Bases
Brianne Wold

MATERIALS:
Chopped red cabbage
Acidic solution (lemon juice or white vinegar)
Basic solution (ammonia)
3-4 glass beakers
Dropper
Homemade pH strips (optional)

PROCEDURE:
1. Chop some of the red cabbage in a food processor. Add water to it, and chop more.
2. Drain the purple juice into a large beaker. Try not to get any chunks. If it is a really dark purple color, just add some more water.
3. Pour samples into two other beakers. To one, add lemon juice one drop at a time and swirl. Wait for the acidity to turn the pH indicator (cabbage juice) pink.
4. To the other beaker, add ammonia the same way using a dropper. Swirl and wait for it to turn turquoise.
5. You can make homemade pH strips by soaking paper in cabbage juice and letting it dry. Then cut it up and dip the ends into various pH solutions.

EXPLANATION:
The cabbage juice is a pH indicator. When you add the acid or base to it, only after a few drops, the color will change. Acids turn pink and bases turn turquoise. You can also make homemade pH strips by using the cabbage juice to soak a normal piece up paper. When you dip the strips into an acid or base, it will turn either a pink or turquoise color again.

SAFETY:
Be careful when using a food chopper for the cabbage. Use caution when dealing with the acids or bases. Ammonia has a pH of 11, which is relatively strong. Its fumes are also strong and overwhelming. Do not inhale vapors directly. When disposing of acids and bases you will want to neutralize the pH. You can add both of your solutions including the cabbage juice together and the pH will be neutralized.

`

Floating Paperclip
Brianne Wold

MATERIALS:
2 beakers, one full of plain water, one full of soapy water
Two paperclips (plain metal, not any plastic coverings on them)
Dropper

PROCEDURE:
Unfold one paperclip and use it as a hook to lower a normal paperclip onto the surface of the water beaker. Get it to float. Use the dropper to put soapy water onto the floating paper clip. This will disrupt the hydrogen bonding and break the surface tension and the paperclip will sink.

EXPLANATION:
The properties of water like surface tension, cohesion, and adhesion allow the low mass paperclip float on the surface. But when the soapy water is added, the hydrogen bonds are disrupted and the paperclip cannot be supported by surface tension and will sink.

`

Fireproof Balloon
David Conway – Chemistry Senior

MATERIALS:
2 large balloons
1 box of matches
1 bottle of water

SETUP:
Prior to the demonstration you will need to blow up both balloons. The first balloon will be blown up normally. The second balloon needs to be blown up but also needs a small amount of water to be added into the balloon (1/2 cup will be fine).

PROCEDURE:
Start off the demo by lighting a match and holding it under the balloon without water. The balloon will pop sometimes before the flame even touches it. Then light a match and hold it under the balloon with the ½ cup of water inside of it. Make sure the flame is under the portion of the balloon with the water. The balloon will not pop. Ask the students what characteristics of the balloon with water allowed it to not pop. Then ask students why water played such a pivotal role in the “strength” of the balloon.

TIPS:
Be sure to use large balloons and do not blow them up too much. Do not overfill or under fill the balloon with water. When putting the match to the balloon with water be sure to hold it under the spot where the water is pooled.

EXPLANATION:
When heat is added to the balloons it heats up the rubber. Normally rubber has a small tolerance for change in heat and will quickly deform and pop as is seen with the first balloon. With the second balloon much of the heat from the flame is dispersed throughout the water. As we all know water is a great absorber of heat. It takes a large amount of heat to change the temperature of water.

SAFETY:
Be sure to wear safety goggles. Extra caution must be implemented anytime flames are present and in use.

`

Floating Water

Jill Crookshanks - Biology

MATERIALS:

Mason jar with lid (pint sized works best)
Fine mesh screen
Water
Overhead transparency (about the size of an index card)

PROCEDURE:

1. First replace the top part of the lid of the mason jar with the fine mesh screen
2. Put water from the tap in the mason jar and fill it as full as you can with water
3. Screw the lid (with the screen instead of the metal) on tight!
4. Place overhead transparency over the top of the lid
5. Flip the mason jar over and watch the transparency stick (as if by magic) to the mason jar
6. Remove the overhead transparency and watch how the water still stays in the mason jar
7. Finally to prove that there are really holes in the screen, tilt the mason jar to a 45 degree angle (over the sink) and the water will pour out

TIPS:

You are going to lose a little bit of water when you first flip it over and when you remove the overhead transparency so make sure to first flip the jar over a trashcan or the sink or if you don't can about getting a little water on the floor it is more dramatic especially if you bring in a mop.

EXPLANATION:

This demonstration will help illustrate some of the properties of water. This one demonstration actually will showcase waters cohesive, adhesive, and surface tension properties. The water will stick to the overhead transparency (adhesion) and the water will stick to itself and the screen holes (cohesive and surface tension). Since water has a high surface tension it will actually create a membrane at the lid of the mason jar even though there are tiny holes that when tilted will allow the water to pass through. The surface tension can be broken by uneven pressure of the water when it is tilted.

`

Blue Bottle Reduction-oxidation Reaction
Kaleo Chung

MATERIALS:

Clear bottle
Methylene blue
Dextrose
Potassium hydroxide
Oxygen in the bottle

PROCEDURE:

Use a clear plastic bottle and combine the dextrose solution and potassium hydroxide in a 50/50 concentration. Add 3-4 drops of methylene blue as an indicator. Methylene blue is widely used as a redox indicator. Put a cap on the bottle and shake. Upon shaking the bottle, oxygen oxidizes methylene blue, and the solution turns blue. The dextrose will gradually reduce the methylene blue to its colorless, reduced form. So, when the dissolved oxygen is entirely consumed, the solution will turn colorless.

CONCEPTS:

On the molecular level, the blue bottle experiment is a complex system composed of ethanol, the simple sugar glucose, the dye methylene blue, the hydroxide ion, and oxygen from the atmosphere. The color change occurs do to a pair of competing reduction-oxidation reactions. Hence, the blue bottle experiment is a wonderful tool for introducing the key concepts of reduction and oxidation.

In first stage of the blue bottle experiment, the methylene blue dye acts as an oxidizing agent and the glucose acts as a reducing agent. The methylene blue oxidizes the glucose to gluconic acid and the glucose reduces the methylene blue to its colorless form. The result is a bottle of colorless solution. When the bottle is shaken, the surface are of the liquid temporarily increases, causing more oxygen to dissolve in the ethanol. The additional oxygen acts as an oxidizing agent and changes methylene blue to its blue, oxidized form. The result is a dramatic color change from colorless to blue.

When the shaking is stopped, the oxygen levels in solution begin to drop. With less oxygen present, the methylene blue once again is reduced to its colorless form by the glucose, and observers will see the color fade and disappear. The color change can be repeated many times simply by shaking the bottle to induce the blue color and then allowing it to sit still in order to make it disappear.

`

Floating Water

Alex Bajorek Senior Earth Science Major

MATERIALS:

Mason Jar with lid (Pint sized)
Fine mesh screen
Water and an Index Card

PROCEDURE:

Put the mesh net over the Mason jar and put on the lid without the top part. Fill the jar with water and cover with the index card. Invert the jar and remove the index card. The water should be suspended in the jar. The index card should also be suspended as well without having to hold it.

EXPLANATION:

This demo is possible due to the surface tension of water. Because of the cohesion between water molecules is so great, it is able to span each gap in the mesh, causing the water to create a membrane at the lid of the jar. Due to this the water will not flow out of the jar unless the surface tension is broken. Also the index card will remain suspended at the lid of the jar due to atmospheric pressure pushing up on the card being greater than the pressure above it.

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"Carbon Dioxide: Ocean Acidity"
Scott Beckley – Post Graduate – Chemistry

DESCRIPTION:

The carbon dioxide produced through respiration and the burning of fossil fuels increases the acidity of the atmosphere and the oceans as the CO_2 reacts with water molecules. When CO_2 is passed through a straw, from the lungs and into a pH-colorimetric aqueous solution, the change in pH that occurs is observed through a color change of the solution, from red to yellow. After about a 24 hour period the pH-colorimetric aqueous solution will change back to the red color, after the CO_2 gas has escaped. The pH-colorimetric aqueous solution can be reused again and again.

MATERIALS:

pH-colorimetric aqueous solution, straw, glass flask

RATIONALE:

This is a demonstration that takes about 15 seconds to demonstrate and about 10 minutes to prepare. The demonstration helps students to understand the reaction of CO_2 with H_2O as supported by a color change when CO_2 from the lungs is added into the H_2O solution that has color changing pH indicators present.

PROCEDURE:

Prepare the pH-colorimetric aqueous solution: Add 26.2 mL of 0.01 M sodium hydroxide to 200 mL of DI water. Dissolve 0.1 g of cresol red in this solution, dilute to 250 mL. Blow through a straw into the pH-colorimetric aqueous solution and observe the solution changing color.

SAFETY:

Do not drink or inhale the solution while blowing air into the straw.

EXPLANATION:

Carbon dioxide changes the pH of water by the following acid forming reaction: $CO_2 + H_2O$ Æ H_2CO_3. The neutral water, with a pH around 7, will become acidic, with a pH of approximately 5.5, when it has been exposed to the CO_2 present in human lungs. As the CO_2 from the lungs is passed into the aqueous solution, the acidity of the solution increases and a color change is observed as a result of the pH-colorimetric indicator, cresol red.

`

Balloon Piercing
Krista Van Allen

MATERIALS:

1. A 10 or 12 inch balloon.
2. A bamboo skewer (or metal rod)10 -12 inches long.
3. Cooking oil.

PROCEDURE:

1. Hold up balloon and ask the audience what they predict will happen if the skewer is inserted into the balloon after it is inflated.
2. Dip the skewer into the oil and gently twist and push the skewer through the thick nipple end of the balloon. Continue to gently twist and push the skewer until it penetrates the surface of the balloon.
3. Continue to gently twist and push the skewer through the balloon until it starts to poke out through the area around the knot. Continue to gently twist and push until the skewer penetrates the knot end of the balloon.
4. Ask the audience if they predicted this result. Then explain the concept behind the demo.

EXPLANATION:

Balloons are made out of thin sheets of rubber latex which in turn are made from many long intertwined strands of polymer molecules. The rubber is stretchy because of the elasticity of the polymer chains. When the balloon is blown up, the polymer strands are stretched. The middle area of the balloon stretches more than the tied end and the nipple end (opposite the tie). A sharp, lubricated point can be pushed through the strands at the tie and nipple ends because the polymer strands will stretch around it. !! A sharp, lubricated point pushed through the strands at the side of the balloon will (usually) pop the balloon because the strands are already stretched and will break. Once a tear begins, it enlarges as the air rushes out of the balloon." (1994, American Chemical Society, Operation Chemistry, Polymers Unit p.4)

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Exploring the Properties of Water
Juliana Coalson

PURPOSE:
To study to surface tension characteristics of water and the influence that a base substance (when introduced to the water) has on the molecular bonds formed between the water molecules.

MATERIALS:
Notebook
A glass dish (or cup)
A small straight pin
Water
Household detergent (Ivory soap)

PROCEDURE:
Fill a glass dish with water. Very carefully, lay a small, straight pin on the surface of the water. What do you observe and why do you think this has occurred? Now, place one drop of household detergent (Ivory dish soap) onto the side of your bowl allowing it to drain down into the water, while the needle is still afloat. What do you observe and why do you think this has occurred? What affect might the detergent have, on the chemical bonds of the water, causing the result that you have observed?

Water has high surface tension. Hydrogen bonds form between water molecules making them "stick" together. When water molecules meet the air this is surface tension is particularly noticeable as water forms an invisible, smooth, connective surface. This layer of water molecules can be surprisingly strong. This allows some insects to "walk on water". This is also why water can make things wet and why it climbs through narrow tubes, called capillary tubes. This "capillary" action helps water move through the soil, up through vessels in plants' stems and through the tiny blood vessels (capillaries) in animals.

Pure water has a neutral pH of 7. When a base, such as Ivory soap is added, the ratio of hydrogen ions to hydroxide ions is no longer neutral but rather has become more basic, due to the increased presence of hydroxide ions (introduced by the addition of a base). One of the unique characteristics of water, as observed through water tension, is disrupted as this base, (hydroxide ions), removes hydrogen ions from the solution - disrupting the beauty of the intermolecular hydrogen bonds…and the surface tension is lost causing the pin to sink

`

Density demo
Jennifer O'Patchen

A. WILL NEED

1. 3 beakers
2. Bic pen caps
3. Water d. Alcohol

B. SET UP/ STEPS

1. Put one pen cap in a beaker filled with water, it will float
2. Put one pen cap in a beaker filled with alcohol, it will sink
3. Put one pen cap in a water/alcohol mixture, it will be suspended in the middle
4. Then have the students figure out the density of the pen cap if they are given the density of water and alcohol OR give the students the density of the pen cap, water and alcohol and have them figure out the density of the mixture

C. CONCEPT

1. Density of mixtures

`

The Mirrored Flask
Lindsey Nelson

MATERIALS:
Glass bottle
Prepare these solution as follows:

A. Dissolve 25.0 grams of sucrose in 250 mL of distilled water and then add 3.0g of tartaric acid. Boil the solution for 10 minutes, cool, and then add 50 mL of ethanol. Dilute to 500 mL. (0.15M sucrose, 0.040M tartaric acid, and 1.70M ethanol)

B. Dissolve 20.0 g of $AgNO_3$ and 3.00 g of NH_4NO_3 in distilled water and dilute to 500 ml. (2.4 M silver nitrate and 0.75M ammonium nitrate)

C. Dissolve 50.0g of NaOH in distilled water and dilute to 500 mL. (2.5M sodium hydroxide.

DIRECTIONS:

1. Clean the glass bottle very well
2. Place warm water in the glass bottle and let sit until the bottle is warm.
3. Pour 10 mL of A into the glass bottle. Then pour 10 mL of B into the bottle. Finally add 10 mL of C.
4. Put a stopper in the bottle
5. Swirl the bottle around
6. When the precipitate begins to form shake the bottle to the precipitate coats the inside of the bottle.
7. Open the bottle and pour the left over solution down the drain with lots of water.
8. Rinse the bottle out with warm water

REACTION TAKING PLACE:

$CH_2OH(CHOH)_4CHO + 2[Ag(NH_3)_2]^{-} + 3OH^{-} \rightarrow 2Ag_s + CH_2OH(CHOH)_4COO^{-} + 4NH_3 + 2H_2O$

This reaction is commonly used in qualitative organic analysis to identify aldehydes. The reaction is classed as a Tollens' test and is performed by mixing aqueous silver nitrate with aqueous ammonia to produce a solution called Tollens' reagent. The reagent contains silver diammine ion. It is an oxidizing agent that will oxidize an aldehyde functional group (-CHO) of the dextrose to a carboxylate ion (-COO-). As this oxidation takes place the silver is reduced form Ag1- to metallic silver. This demo works for an AP chemistry class learning about organic chemistry because of the functional groups involved in this reaction. This is also a good demo for a general chemistry class because of the redox reaction process taking place.

`

Liquid Nitrogen Ice Cream
Lindsey Nelson

MATERIALS:

- Large plastic bowl
- Wooden spoon
- 5 or more liters of liquid nitrogen
- gloves and goggles
- 4 cups heavy cream (whipping cream)
- 1-1/2 cups half-and-half
- 1-3/4 cups sugar
- 1 quart mashed fresh strawberries or thawed frozen berries

DIRECTIONS:

1. First, mix the cream, half-and-half, and sugar in the bowl. Mix until the sugar is completely dissolved.
2. Put on gloves and goggles.
3. Slowly start pouring the liquid nitrogen directly into the bowl containing your other ingredients.
4. Stir the mixture constantly while continuing to add the liquid nitrogen.
5. As soon as the ice cream starts to thicken, add the mashed strawberries. Stir vigorously.
6. Keep adding liquid nitrogen to the ice cream until it becomes too solid to stir. Let any excess liquid nitrogen boil away before serving.

DISCUSSION:

Liquid nitrogen has an extremely low boiling point, -196 degrees Celsius. It is a cryogenic fluid and it will freeze most anything it comes in contact with very fast. Normally the cream base used to make ice cream slowly freezes but when using liquid nitrogen it happens in minutes. As the liquid nitrogen is released from its container, it starts to turn to a gas. This demo is good for showing different types of phase changes. The liquid base of the ice cream turns from a liquid to a solid in the freezing process while the liquid nitrogen turns from a liquid to a gas in the boiling process. This shows how different elements have different properties such as boiling and freezing temperatures.

`

Water Density Demonstration: Temperature

Sarah LePage

PURPOSE:

To show how temperature affects the density of water

CONCEPTS:

When the temperature is high, molecules in water disperse and move around more rapidly than they usually do in order to spread the heat energy. When the temperature is low, water molecules move less and lose energy, and because of this, the space that they move in becomes smaller. Since there is less space and yet the same number of molecules, the density increases.

MATERIALS:

Glass Baking Pan
Cardboard
800 ml Hot Water
Flash Light
800 ml Cold Water
Food Coloring (two colors)

PROCEDURE:

1. Place a couple drops of food coloring in 800 ml of cold water
2. Place a couple drops of a second color in 800 ml of hot water
3. Cut a piece of cardboard to fit snugly in the middle of the glass baking pan
4. With help, hold the cardboard separator in place and then pour each sample of colored water on either side of the cardboard
5. Remove the cardboard separator and observe the density differences

Note: You may find it helpful to shine a flashlight on either side of the baking dish

`

Water Density Demonstration: Salinity
Sarah LePage

PURPOSE:
To show how salinity affects the density of water

CONCEPTS:
When you add salt to water, the salt dissolves into ions. The volume increases a small factor, but the mass increases by an even greater factor. This is because the salt ions are attracted to the water and bind closely to the water molecules themselves. Since the mass increases faster than the volume increases when you add salt, the density increases. Salt Water is more dense than regular water because for a certain volume, there is more mass (or stuff) in the salt water than there is in the normal water.

MATERIALS:
2- 1 Liter beakers
Cardboard
Spoon
700 ml tap water in each beaker
2 golf balls
Food coloring
150 grams of non-iodized salt

PROCEDURE:
1. Dissolve the salt into one of the beakers of water
2. Place a golf ball into each beaker, and observe the difference in each golf ball
3. Remove golf balls and add a few drops of food coloring to the beaker of fresh water
4. Using the spoon to cushion the fall, pour some of the colored freshwater into the beaker containing the salty water, and observe the difference in each sample of water
5. Gently place a golf ball into the beaker near the boundary created by the layers of salt/fresh water, and observe the location of the golf ball

`

Supercool Water
Brent Hoeppner

INTRODUCTION

Temperature is a measure of the average speed of the molecules that make up the matter. The higher the temperature the faster the molecules are moving and the lower the temperature the slower the molecules are moving. This motion controls the phase that different matter is in. Water freezes at 0°C or 32° F. Water is able to stay a liquid below its freezing point, called supercooling. When the temperature of water lowers ice crystals form around impurities in the water so in order to supercool water the water must be pure. After the water is in the supercooled state, any disturbance will suddenly freeze the entire container of water into ice.

MATERIALS

- Bucket
- Ice
- Salt
- DI water
- Cup

PROCEDURE

1. Pour some of the DI water into the cup
2. Place cup in the center of the bucket
3. Pour ice cubes into bucket, do not get any ice into the cup
4. Sprinkle about 2tbsp of salt onto ice, do not get any salt into the cup
5. Should take around 10-20 min to supercool
6. Take out of ice and supercooled water is ready

CONCLUSION

Supercooled water becomes colder than its freezing point and stays a liquid when most water would turn into a solid. This can only happen because the water is pure. Supercooled water occurs in nature in some clouds and can pose problems for airplanes when they fly through and the supercooled water in the clouds suddenly freezes onto the plane. Some plants use this method and supercool their fluid to survive extremely low temperatures.

`

Fire Extinguisher
Tyler Zitek -Chemistry

MATERIALS:
Stair step apparatus or vapor ramp
Matches
Tea
Candles
Vinegar
Baking Soda
Pitcher

PROCEDURE:
Set up the stair step apparatus or the vapor ramp and light the candles. In a pitcher mix baking soda and vinegar and close the lid (experiment with the amount of each to avoid overflow or the lid popping off). Next, pour the liquid out into a separate container after it stops fizzing. The pitcher should be left with carbon dioxide. Make sure to get all the liquid out so that it is clear that the gas is putting out the fire, and not any liquid that may have been in the pitcher.

EXPLANATION:
Carbon dioxide is denser than air. The stair step or vapor ramp allows the carbon dioxide to settle. Since combustion needs oxygen to take place, the carbon dioxide settles and forces out all of the excess oxygen, and thereby extinguishing the candles.

TIPS:
Mix the baking soda and vinegar up to 15 minutes before pouring it. This allows more carbon dioxide to build up and accumulate in the pitcher. Make sure all liquid is out of the pitcher before dumping the gas on into the ramp.

`

Leaky Bag Tyler
Zitek -Chemistry

MATERIALS:
Ziploc bag (any size, gallon size is easiest to see)
Water
Sharpened pencils

PROCEDURE:
Fill the bag about two thirds full of water. Hold the bag so everyone can see. Then stick the pencils through the bag, making sure to go in so that both ends of the pencil end up under the water line. You can do this as many times as you want.

EXPLANATION:
Plastic bags are made up of long strands of molecules called monomers. One of the properties of polymers is elasticity, which is illustrated here. When the pencil is pushed through the bag, the monomers stretch, allowing the pencil through, and then retract, resealing the hole around the pencil.

`

Volume vs. Temperature Using Balloons
Kaylyn James-Senior Earth Science Major

MATERIALS:
-two different colored balloons
-plastic bin
-liquid nitrogen with storage container
-forceps
-gloves

PROCEDURE:
1. Set plastic bin on a flat, sturdy surface
2. Uncap container with liquid nitrogen
3. Pour liquid nitrogen in plastic container
4. Blow up balloons
5. Place balloons in container with liquid nitrogen
6. Present result and allow balloons to expand, again

This demonstration is based on the Gas Laws and will be presented using inflated balloons and liquid nitrogen. When the balloons are inflated, the gas particles in there are moving are moving at a reasonably fast pace due to the warm temperature, as temperature increases the particles move faster and continue to expand the balloons. When the balloons are placed in the bin of liquid nitrogen, immediately the balloons will contract, resulting in no loss of gas particles but the gas particles are moving slower causing the balloon to shrink. Once the balloons are removed from the liquid nitrogen, the gas particles begin to move faster and inflate the balloon to the original state. There is no loss or gain of the gas particles, the compaction or expansion of the balloon is based on the temperatures effect on the movement of gas particles.

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Jessica Cihiwsky – Senior Biology Major

HYDROPHOBIC VS HYDROPHILIC FORCES AS OBSERVED ON GRAPES

Materials

• one peeled grape
• one unpeeled grape
• 7-up soda.
• A cup

The teacher pours non-flat soda into one cup. The two grapes are dropped at the same time. The presence of the hydrophobic skin is observed by seeing the unpeeled grape rise to the top of the cup while the peeled grape remains at the bottom. The reason for the increased altitude for the unpeeled grape is that the skin has hydrophobic interactions to the upward escaping carbon dioxide gas. This experiment can be done at as many student locations the teacher deems necessary as it is very cost effective and very safe for the students to handle.

INFLATING A BALLOON WITHOUT A BREATH!

Materials: bottle, vinegar, small piece of paper towel, baking soda, and a balloon.

Steps: 1. fill bottle with vinegar (enough to cover bottom of bottle)

2. pour baking soda onto small piece of paper towel (paper towel is used to delay reation so that you can get balloon on bottle)

3. put paper towel with baking soda into bottle

4. cover opening of bottle with balloon (hold onto balloon, so that the gas does not blow away the balloon)

5. enjoy the show

`

Nicole Poling – Post graduate - Biology

ICE ON A STRING

Science Concept Demonstrated: NaCl (table salt) lowers the melting point of water.

Materials:

- 1 piece of thin string
- 1 large ice cube
- NaCl (table salt)
- small cup of water
- plate

Directions:

Place the ice cube on the plate. Dip the end of the string into the cup of water, making sure at least an inch of the string is wet. Lay the string on top of the ice cube. Sprinkle salt over the string, making sure to cover all of the string that is touching the ice cube.

Wait 10-20 seconds. Pick the string up- the ice cube should lift up with it.

Introduction:

"Have you ever wanted to put some ice cubes into your drink but you didn't want to get your fingers wet and cold? Well, I know how to do it! I can pick up this ice cube without getting my hands cold or wet. Just watch!"

Explanation:

Salt has the ability to make the melting point of water or ice lower than it usually is. When salt is poured on the ice, it causes the melting point of the ice to lower slightly. This allows the string on top of the ice cube to sink into the ice cube slightly. The water re-freezes itself around the string fairly quickly, almost as if the string were a part of the ice cube all along. The ice cube then lifts up easily. We use this in winter- salt is sprinkled on the sidewalk in order to keep the ice from forming. The salt lowers the melting point of the ice and it doesn't ice up the streets.

Important Note: Make sure to sprinkle enough salt over the string and wait for a few seconds or else the ice cube won't lift up with the string...

Waste Disposal: Dump ice cube in a sink so it will melt into water and can then be washed away.

`

Andy Russell – Post Graduate – Biology

"WHOOSH" TUBE

Materials:

Large plastic container, e.g. a 5-gallon water cooler bottle
Small volume of 95% denatured ethyl alcohol (at most, 50ml)
Splint (paper, preferably)
Source of fire (lighter, match, etc.)

Rationale:

This is a demonstration that takes about 30 seconds to prepare and is always a crowd-pleaser. Even the most disengaged student will no longer be able to claim that chemistry is boring.

Procedure:

Pour the ethyl alcohol into the large bottle and swirl it around until the insides of the container are coated in a thin layer. Stand the bottle on its base, light the splint, and drop it into the bottle. Try not to jump backwards.

Safety:

The "whoosh" is fairly loud, but not going to hurt anyone. The ethyl alcohol needs to be stored in a locked cabinet. A little goes a long way.

`

Sarah Butler – Senior- Chemistry

MACRO REPRESENTATION OF CHROMATOGRAPHY:

Materials:

- Seed beads of varying sized
- Clear plastic tube that becomes narrow at one end (a 16 fl oz water bottle works well)
- Ping- pong balls (enough to fill the clear tube)
- Funnel
- Small catch tube (should be narrow enough that mixing will not occur as the beads drop in and have a closed end)

Set- up:

Before class: If using a water bottle the larger end should be cut off, but only cut off enough to have that end open enough to get the ping- pong balls in. The larger plastic tube is placed over the funnel and the funnel is placed in the smaller catch tube. The large plastic tube is packed with ping- pong balls. The seed beads should be mixed so that they are uniformly distributed.

In class: Place the set up on a table in front of the class so everyone can see. Show the class the mixture of seed beads and have them hypothesize how long it will take to separate the beads out by size. Then pour the beads through the apparatus. They should separate by size so that the smallest ones come out first.

Explanation:

The mixture of beads represents a liquid or gas mixture that we put through chromatography. The beads take longer to go through based on size because larger beads spend more time in contact with the ping- pong balls, slowing them down. This is how chromatography works. The different molecules come out at different times based on their size and how they interact with the stationary phase.

Reference:

Journal of Chemical Education, Volume 63, 1986, page 715

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Sarah Butheres – Senior – Biology

BLOWING UP A BALLOON WITH A CHEMICAL REACTION

Materials
- Vinegar
- Baking Soda
- Water Bottle
- Funnel

Procedure:
Pour the vinegar into the bottle so 1/3 of it is full. Place 3 teaspoons of baking soda into a balloon. Vary carefully attach the balloon onto the top of the water bottle without mixing the vinegar and baking soda. To start the reaction tip the balloon upwards so the baking soda falls into the vinegar. The balloon will inflate.

Why:
Combining vinegar and baking soda is an example of an acid base reaction and a decomposition reaction. When the two ingredients are mixed, hydrogen ions (H+) from the vinegar react with the bicarbonate ions (HCO3-) from the baking soda to form a new chemical called carbonic acid (H2CO3).

$$H^+ + HCO_3^- \text{--->} H_2CO_3$$

The carbonic acid thus formed then immediately decomposes into carbon dioxide gas (CO2)and water (H2O).

$$H_2CO_3 \text{--->} H_2O + CO_2$$

It's this carbon dioxide gas that you see bubbling and foaming as soon as you mix baking soda and vinegar together. Using the molecular structures of only the components involved, the chemical reaction can be written: baking soda and vinegar reaction The overall reaction however, is often written as follows:

$$NaHCO_3\ (aq) + CH_3COOH\ (aq) \text{---->} CO_2\ (g) + H_2O\ (l) + CH_3COONa\ (aq)$$

`

CORNSTARCH AND WATER

Materials:

Cornstarch
Water
Bowl

Directions:

1. Pour approximately 1/4 of the box (about 4 oz.) of cornstarch into the mixing bowl and slowly add about a half a cup of water. Stir. Sometimes it is easier to mix the cornstarch and water with your bare hands (of course, this only adds to the fun).
2. Continue adding cornstarch and water in small amounts until you get a mixture that has the consistency of honey. It may take a little work to get the consistency just right, but you will eventually end up mixing one box of cornstarch with roughly 1 to 2 cups of water. Notice that the mixture gets thicker or more viscous as you add more cornstarch.
3. Sink your hand into the bowl and notice its unusual consistency. Compare what it feels like to move your hand around slowly and then very fast. Sink you entire hand into the goo and try to grab the fluid and pull it up.

Purpose:

The cornstarch and water stirred together create a mixture. When the solid grains of cornstarch are evenly spaced apart in the water, the starch grains slide easily past one another, as liquids do. When the mixture is squeezed, the grains are pushed together. This pressure makes the starch molecules stick together in a different way, so the mixture acts like a solid. When the pressure stops, the molecules come unstuck again, returning the mixture to liquid form.

All fluids have a property known as viscosity - the measurable thickness or resistance to flow in a fluid. Honey and ketchup are liquids that have a high resistance to flow. Water has a low viscosity. Newton said that viscosity is a function of temperature. The cornstarch and water mixture is an examples of non-Newtonian fluids because their viscosity changes when stress or a force is applied.

`

SOLUBILITY

Materials:

1. One can of soda.
2. A glass container
3. Table salt
4. Teaspoon
5. Basin (to catch the overflow)

Procedure:

1. Pour the soda into the glass. Try to tip the glass and pour along the side so that the pop doesn't fizz too much. Then pour about one teaspoon or more salt into the glass with soda. This extra solute should make the soda fizz, which relates to gas being released due to excess solute and only a certain amount able to be dissolved by the soda.

Rationale:

Salt is very soluble in water. Air dissolves in water, but not very well, especially compared to salt. In a solution, the solvent (the water in this case) can only hold so much solute (stuff like salt, sugar, air, etc.) When the salt is added to the water, the water can't hold as much dissolved air in it, so the air escapes and we see the fizz.

A good example of this is pressure and fish or scuba divers. The deeper you go the higher the pressure gets and when there is higher pressure, the more solute that can be dissolved in a solution. So if a fish were to be brought up quickly or even a scuba diver swam up to quickly, the air would be released from the blood too quickly, potentially being fatal. It is necessary to understand that the higher in water you get or even the atmosphere, the pressure decreases and thus the amount of solute that can be dissolved also decreases. Gas is the easiest to dissipate from a solution, which is why you usually see a release of gas, thus the fizzing in the soda can.

`

Sean Scribbick – Senior – Biology Major

BURNING MONEY CHEMISTRY DEMONSTRATION

Scientific Concept behind Burning Money

A combustion reaction occurs between alcohol and oxygen, producing heat and light (energy) and carbon dioxide and water.

$$C_2H_5OH + 4\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O + \text{energy}$$

When the bill is soaked an alcohol-water solution, the alcohol has a high vapor pressure and is mainly on the outside of the material (a bill is more like fabric than paper, which is nice, if you've ever accidentally washed one). When the bill is lit, the alcohol is what actually burns. The temperature at which the alcohol burns is not high enough to evaporate the water, which has a high specific heat, so the bill remains wet and isn't able to catch fire on its own. After the alcohol has burned, the flame goes out, leaving a slightly damp dollar bill.

Materials:

Here is what you need to perform the burning money demonstration:

- dollar bill (higher denomination if you're brave)
- tongs
- matches or a lighter
- salt (or one of these chemicals if you want a colored flame)
- solution of 50% alcohol and 50% water (you can mix 95% alcohol with water in a 1:1 ratio, if desired)

Performing the Experiment

- Prepare the alcohol and water solution. You can mix 50 ml of water with 50 ml of 95-100% alcohol.
- Add a pinch salt or other colorant to the alcohol/water solution, to help produce a visible flame.
- Soak a dollar bill in the alcohol/water solution so that it is thoroughly wet.
- Use tongs to pick up the bill. Allow any excess liquid to drain. Move the damp bill away from the alcohol-water solution.
- Light the bill on fire and allow it to burn until the flame goes out.

Safety!!!

This is an experiment involving fire. Have a source to extinguish the fire in case of an emergency occurs.

Sources:

http://chemistry.about.com/od/demonstrationsexperiments/ss/burnmoney_3.htm

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Brooks Williamson - Post Graduate – Chemistry

GAS-PHASE ACID-BASE REACTION

Materials:

- 2 flasks
- 2 rubber stoppers
- conc. HCl
- conc. NH_3

Place both vessels on a dark surface (or in front of a dark backdrop). Unstopper vessels. What appears to be vapors is in fact the product of an acid-base reaction occuring in the gas phase:

$HCl\ (g) + NH_3\ (g) \rightarrow NH_4Cl\ (s)$

`

Lenae Anderson – Senior Chemistry
Major Universal Indicator with a Basic Solution and Dry Ice

Materials:

· Universal Indicator
· Dry Ice
· Ammonia
· Water
· Beaker
· Tongs to handle

Procedure:

Add universal indicator to half a beaker of water. Add ammonia until the solution turns purple. If the color becomes washed out looking at this point add more universal indicator. Put a piece of dry ice in the solution. Explanation: The dry ice sublimates into carbon dioxide. As this bubble through the solution it reacts with water according to the following reactions CO2 + H2O à H2CO3 H2CO3 +H2Oà H3O+ + HCO3 - This causes the solution to become more acidic, changing the color of the universal indicator.

`

Potato Battery

Materials:

· 3 Potatoes
· Low voltage LED
· A piece of copper (this can be found in the plumbing section of a hardware store)
· A piece of zinc (many bolts are made out of zinc)
· Banana clips

Procedure:

Put the piece of copper and the piece of zinc in a potato about one inch from each other. Do this to two other potatoes. Take the zinc electrode from the first potato and connect it to the copper electrode on the second potato. Take the zinc electrode from the second potato and connect it to the copper electrode on the third potato. Then take the zinc electrode from the third potato and connect it to one side of the led light. Then take the copper electrode from the first potato and attach it to the other side of the LED. This should cause the light to light up, if it doesn't, try switching the sides of the light each side of the battery is attached to.

Explanation:

The copper serves as the cathode and the zinc serves as an anode. At the anode, zinc is oxidized and at the cathode, hydrogen ions are reduced to make hydrogen gas. The electrons required to cause this oxidation and reduction travel through the wires, and through the light to do this, causing the light to light up. Three potatoes are needed for this demonstration in series in order to light up a light, because a potato on its own does not cause the light to light up.

`

Kelsey Barnes – Graduate Chemistry Major (undergrad. Chem. Major)

Candle in a Bottle

Materials:

Candle (emergency candles work well)
250 mL Erlenmeyer Flask (or flask tall enough to set over candle) Matches
Baking dish or other flat dish with sides
Water
Food coloring

Procedure and Explanation:

Light the candle and drip a few drops of wax in the center of the dish. Place the candle straight up in the pool of wax. Fill the dish with water about 0.5 in high. Place a few drops of food coloring in the water. Light the candle and hold the Erlenmeyer over the candle for about a minute. The air inside will heat and expand. Then place the Erlenmeyer over the candle and set down in the dish. (Watch the water) When the candle burns all the oxygen in the air inside the Erlenmeyer it will extinguish. The air in the Erlenmeyer will then cools and the volume decrease resulting in the water rising. This process can be repeated several times, but be careful not to get the wick of the candle wet.

`

Acid in the Eye

Materials:

Hydrochloric, sulfuric and nitric acid, 6M or stronger
Sodium hydroxide, 6M or stronger
Raw eggs or egg whites
Petri dish Beral pipets Overhead projector Permanent marker

Procedure:

* Draw an eye on the bottom of the Petri dish with permanent marker. Crack the egg and separate the whites from the yoke. Place the egg whites in the Petri dish on overhead projector.
* Discuss similarities between egg white and the human eye.
* Using Beral pipet, place drops of acid on the egg white (it will immediately become opaque). You can rinse the egg with water to show it does not “undo” the damage.
* Repeat with new egg whites and other acids.
* Nitric acid turns egg whites bright yellow. Strong sodium hydroxide will not discolor egg whites but solidifies them. Acids less than 6M can work, but results are not as dramatic.

`

Dry Ice Eruption

Purpose:

- To have some fun in a science classroom!
- Discuss sublimation of dry ice (from solid to gas) and being able to trap this gas in bubbles

Materials:

- Tall graduated cylinder
- Very hot water
- Liquid dish soap
- Tongs/thick gloves
- Garbage bag or towel

Procedure:

- Set the tall graduated cylinder on top of a towel or garbage bag; this will save you some clean-up time later
- Fill 1/3 of the tall graduated cylinder with extremely hot water
- Using gloves/tongs drop in a few good-sized chunks of dry ice
- Watch the release of carbon dioxide
- Squirt in liquid dish soap
    - If it's colorful, the liquid at the bottom will change colors which is cool to see as well; it adds to the overall look of the demonstration
- Watch the dry ice eruption!
- Play with the bubbles and 'pop' them in your hands and watch them turn back into gaseous carbon dioxide

Safety Precautions:

- Always handle dry ice with tongs or thick gloves, it is extremely cold and can cause frostbite very quickly
- Be careful with using extremely hot water, don't burn yourself!

Source:

- http://www.youtube.com/watch?v=gNdoUCgRXYo&feature=related
    - He has a number of excellent science videos on youtube; his ID is mrbrunnerutah

`

Stacie Santoro – Senior Biology Major

Lava Lamp

Introduction

This Demonstration is used to show students the difference between densities of fluids. It's important for students to recognize that more dense fluids will sink, while less dense fluids will float on top.

Materials

Water
Food Coloring Vegetable Oil Salt
1 Large Graduated Cylinder

Procedure

- Mix water and food coloring and pour the mixture into the large graduated cylinder. Make sure the graduated cylinder is clear so the audience can see the fluid.
- Pour some vegetable oil on the surface of the water in the graduated cylinder.
- Pour salt into the graduated cylinder and watch as the oil sinks in the graduated cylinder.

Discussion

This demonstration shows differences in densities between fluids. The oil is less dense so it will float on the top of the water, but as soon as the salt is introduced into the graduated cylinder, the salt and oil adhere and sink to the bottom. This is called the lava lamp because it's similar to a real lava lamp, except those use different materials.

`

Harry Potter **Practice of Potions**

Introduction:

This is a unique demonstration demonstrating density of different liquids. Students will be able to explore the densities of these liquids in a fun, unique way

Materials:

150 mL beaker
50 mL graduated cylinder
Standard test tube
250 mL measuring
cup Stirring rod
pipette/dropper

Water-standard potioning water
Goblin Snot – a yellow and slimy substance commonly used in cooking greasy foods and often obtained from dampened Kleenex. Although a rather nasty substance by itself, Goblin Snot magically prevents food from sticking to its coking container. (vegetable oil)
Dragon Saliva – A clear yet harshly alcoholic smelling substance that ignites rather quicker in the presence of fire. Although difficult to obtain, Dragon Saliva has powerful healing and cleansing abilities and is often used to aid the injured. (rubbing alcohol)
Leech Juice – A bright red substance that draws its color from a leeches primary diet. Although pure Leech Blood contains many nutrients, Leech Juice has these filtered out resulting in a simple red dye. (Red food coloring)
Stinkbug Stink – A green substance that generally gills a room with noxious and foul smells. Fortunately, you should have access to Descented Stinkbug Stink, which retains the wonderful green dye properties of normal Stinkbug Stink without the unpleasant odors.

Procedure:

- Use a graduated cylinder to obtain 50 mL of Dragon Saliva (alcohol).
- Pour Dragon Saliva into a beaker
- Use a graduated cylinder to obtain 40 mL of water. Make sure when pouring water into the Dragon Saliva, you hold the beaker at a slight angle and let the water run down the side of the beaker. This will prevent cloudiness from occurring.
- Set the beaker aside after the water has been added.
- Fill the test tube half way with Goblin Snot (vegetable oil)
- Pour the Goblin Snot into the measuring cup
- Add 7 drops of Leech Juice to the Goblin Snot. (red food coloring to vegetable oil).
- Add 7 drops of Stinkbug Stink to the Goblin Snot. (green food coloring to vegetable oil).
- Use the stirring rod to mix the Goblin Snot, Leech Juice, and Stinkbug Stink together. Do this until the liquid becomes entirely dark, forming a compound.
- Fill the dropper/pipette with the Goblin Snot, Leech Juice, and Stinkbug Stink mixture.
- Drop the mixture into the beaker of water and Dragon Saliva.
- Note where the Goblin snot balls float
- Wait and watch the floating balls transform into floating-dripping balls.
- After the dripping stage is finished, use the stirring rod to stir the liquids together.
- Wait for the potion to come to a rest and observe the different densities of the liquids. You should be left with a purple fluid that flows like water with a nasty slime layer floating on top.

Discussion

The Goblin Snot balls flat when they are first added to the beaker because they are less dense. The Goblin Snot, Leech Juice, and Stinkbug Stink formed a mixture. The Leech Juice and Stinkbug Stink were more dense when added to the potion, so they sank. The resulting potion should have Leech Juice and Stinkbug Stink at the very bottom, water next with Goblin Snot floating on top of that, and the Dragon Saliva floated on the top.

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Dowdy, Tandy M
Senior – Chemistry

Dry Ice with Universal Indicator Demonstration

Topic: Acid/Base Chemistry and Neutralizations

Materials: Eye Protection
Large Graduated Cylinder (2L)
Tongs (for transferring dry ice)
Heavy Gloves (for transferring dry ice)
Dry Ice
Household Ammonia
Water
Universal Indicator
Long stirring rod

Safety Concerns: Wear eye protection and use gloves to handle the dry ice because it can cause severe frost burns.

Procedure: Fill the 2L graduated cylinder with water and add enough universal indicator to have an easily visible color. Then add a few mL of ammonia to make the solution alkaline. Stir with stirring rod to mix solution thoroughly. Add several chunks of dry ice to the solution. It will sink and will start to give of CO_2 gas. As the CO_2 is given off the solution will begin to change in color as the pH changes. The CO_2 reacts with the water in the solution to produce carbonic acid. The gradual change from a weak base to an acid will take the universal indicator through a range of colors.

This can be used to talk about neutralization when acids and bases are mixed. It could also be used to talk about what happens in titrations of weak acids and strong bases (buffers).

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Underwater Volcano Demonstration

Topic: Density This demonstration illustrates the concept of density. Because the hot water at the bottom of the jar is less dense that the surrounding cold water, it rises to the surface of the cold water and appears to be an underwater volcano.

Materials:
One liter beaker
One small Erlenmeyer Flask (that fits completely inside the beaker)

Cold water (cooled with ice and let melt)

Hot water with dark food coloring

Foil

Pencil

Piece of string

Procedure: Fill the liter beaker with melted ice water (cold).
Fill the Erlenmeyer flask with hot water and add food coloring to the water.
While the flask is hot put foil over the top.
Tie the string around the top of the flask leaving enough of a tail to be able to lower the flask into the beaker.
Place the flask, using the string, at the bottom of the beaker.
When the flask is sitting on the bottom, use the pencil to poke a hole in the top of the foil. Make this hole as big as the pencil so the liquid can get through.
The hot water will then rise to the surface as if it were smoke from a smokestack.

Explanation: An liquid with less density will layer on top of a more dense liquid. It gives the appearance of "floating" above the more dense liquid. Hot water is less dense than cold water so when submerged in cold water it will rise to the top of the more dense material. Other applications: weather, air conditioners, hot air balloons.

Safety: Be careful when handling hot liquids, use tongs.

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Sodapop and Salt

Materials: Can of Soda, Glass container, Salt, Teaspoon, basin to catch fizz

Procedure: 1) Pour soda into glass without producing much fizz. 2) Pour about a teaspoon of salt into the pop. 3) Observe

What happens: There is already a lot of gas dissolved in the sugar water of pop. Salt is more soluble in water than the gas is so when the salt is added the water can't hold so much stuff dissolved in it so the gas escapes causing fizzing. ~Temperature and pressure also determine the solubility of gas in water. ex. pressure change of divers and fish

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Rewerts, Tamara
Graduate – Chemistry

The Dissolving Cup

Note: In this lab, the Styrofoam is no dissolved, it is degassed. If the Styrofoam were to dissolve there would be so 'slime' left over. If it were to dissolve it would become part of the liquid.

Materials: A pie plate
50 mL water in a 100 mL glass beaker
50 mL acetone in a 100 mL glass beaker(this can be replaced by fingernail polish, but 100% acetone is available at some stores) styrofoam cups

Procedure:
1. Hold one cup over a pie plate and pour water into the styrofoam cup (nothing happens).
2. Pour acetone into another of the styrofoam cups (the bottom will fall out) into the pie plate.
3. Finish by putting the cup into the pie plate and watching it disappear.

Alternative Procedure:
1. Start with two pie plates and put about 1/2 inch of acetone in the bottom of one and the same amount of water in the second one.
2. Have a race to see who can make the tallest tower of cups.
3. The cups in the acetone will slowly dissolve and shrink into the acetone, while the ones in the water will remain intact.

Two ways to discuss this demonstration in your classroom:

Safety - never drink anything in lab. This is a good example of this, two colorless liquids that appear to be water, yet one is not. The results show you why you should not assume that something in the lab that looks like water, is water! You may introduce this by pouring the water into the styrofoam cup and drinking it. Then pour the acetone into the other cup, pretend you are still thirsty and attempt to drink out of it. The results show you why no one should assume that something in the lab that looks like water, is water.

Like Dissolves Like - styrofoam is a polymer consisting of a long chain of monomers that are held together by non-polar bond interactions, thus styrofoam is non-polar. When acetone - a non-polar solvent - is poured into the cup, it dissolves because they are both non-polar. The cup did not dissolve in the water because water is polar and will not dissolve a non-polar substance. Make sure to clarify to your classroom that the cup is not melting in the acetone (the acetone is not hot!), it is dissolving because of their similiar polarities.

Safety: No particular cautions are needed

Disposal: The gooey solid can be disposed of into the trash can. You can leave the acetone in the pie plate and allow it to evaporate and then wash out the pie plate, or you can pour off the extra liquid down the drain.

Source: Elmhurst College Demonstrations

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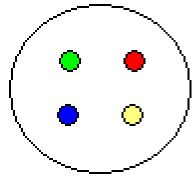
Riddle, Kate

Senior – Eath Sciences

Tie-Dyed Milk

Principles: This demonstration addresses the property of surface tension. Surface tension is the energy required to increase the surface area of a liquid by a unit amount. Liquids like water and milk have surface tension due to the cohesive forces of the liquid's molecules. The demonstration will show how soap can reduce the surface tension in milk.



Materials:

A shallow clear dish

Milk (whole or 2%) (room temperature)

Food coloring (four different colors)

Liquid dish soap

Procedure:

1. Pour a 1-2cm layer of milk into the dish
2. Put one drop of each of the four food colors onto the surface of the milk, separated from each other.
3. Drop one drop of dish soap onto the surface of the milk in the center of the dish. Do not drop the soap on top of the food coloring drops.
4. Observe what happens next!

Source: coolscience.org; Dr. David Anderson

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Tallaksen, Lisa

Senior – Biology

The Hydrophobic Nature of Grapes

Materials: Grapes, colorless soda (1-L bottle), knife to peel grapes

Purpose: This demonstration is used to show the hydrophobic (nonpolar) nature of cell membranes using grapes.

Procedure: Pour out approximately 200ml of soda from a newly opened bottle. Have five peeled grapes and ask the students what they think will happen when you add them to the 1-L of soda. Also ask the students what they think will happen to the grapes that have not been peeled. First drop the unpeeled grapes in and watch what happens. Then add the peeled grapes to the bottle and observe what happens. Do not replace the cap after adding the grapes. Have the students explain what happened. After a short discussion about cell membranes ask the students what they would expect to happen if the cap was screwed back on.

Explanation: This demonstration shows how the nonpolar carbon dioxide molecules clinging to the surface of the grape while water molecules are being repelled. In the peeled grape, which lacks the hydrophobic skin, the water molecules are attracted to the surface and the carbon dioxide gas is repelled, resulting in the peeled grapes sinking. The unpeeled grapes will float to the surface because of the low density of the carbon dioxide. At the surface the gas is detached and the grape sinks back down. The process will then continue.

Note: When doing this demonstration make sure that students do not get the misconception that the unpeeled grapes are sinking because they weigh less or have a lower density because the skin has been removed.

Source: Borislaw Bilash II, and Martin Shields. A Demo A Day- A Year of Biological Demonstrations

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Pressure Demonstration

Materials: 12’’ balloon, aluminum can with the top cut out, tape, 2 beakers, ice, hot plate, tongs, rubber bands, water

Purpose: To show how temperature affects the pressure

Procedure: Cut the top of a soda can out. Then cut a balloon so you are left with the widest portion. Place the balloon over the top of the can and put a rubber band around the top to insure that the balloon will remain in place. Have two beakers, one filled with ice water and the other filled with water that has been heated on the hot plate. Place the device into the cold water and watch the balloon sink into the can. Then place the can into the hot water and watch the balloon rise. Continue with a class discussion explaining how temperature, kinetic energy, and pressure are related.

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Earth Science Major

#1. Magic Ice (Density Demo)

Materials: Two 400 ml beakers, one graduated cylinder, vegetable or corn oil, ethyl alcohol, ice that contains food coloring, water.

Procedure: Fill beakers with water and alcohol. Fill the graduated cylinder with oil. Ask audience what will happen in each instance. In water ice will float, in alcohol ice will sink, and in the oil the ice should float and the water will sink to the bottom.

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#2. EGG DENSITY

Materials:

3 eggs

3 - 400 mL beakers

225 mL water

225 mL of 3 M hydrochloric acid (You may substitute vinegar for the hydrochloric acid)

225 mL salt water (60 g of sodium chloride dissolved in 225 ml water)

Long pair of tongs or a spoon

Procedure: Fill three beakers with water, HCl, and salt water mixture. Ask the audience what will happen in each beaker. In the water it will sink, in the salt it will float (if not add more salt), and in the HCl it will swim. The HCl will dissolve the egg shell. Gas bubbles will form. This is carbon dioxide.

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Demonstration by Kathryn Dai

Earth Science Major

#8. THE ICE CUBE LIFTER!

The objective of this demo is to show that salt lowers the melting and freezing point of water.

Materials:

Ice cubes, a cup of cold water, a piece of yarn or thread and a salt shaker.

Procedure:

Place the ice cube in the cup of cold water and let it sit for a minute. Show the audience the salt and the thread and ask "How can I lift the ice cube out of the water using these two things without going under the ice and lifting it out? Place the yarn on top of the ice cube and sprinkle a good shake over the ice cube and string. Leave for a minute to two minutes and then lift the ice cube gently out of the water by the string.

Some questions to ask…

1. What does salting the roads in the winter time do to the snow and ice on the road?
2. What temperature does ice melt?
3. How does salt affect the melting point?
4. Where else in our lives do we find the use of salt to lower the freezing point of water?

Salt water has a lower melting or freezing point than fresh water. The addition of salt to the ice makes it melt where the salt hits it. Placing the string where the salt was sprinkled (on the melted part of the ice) sticks because the temperature above the ice cube is below 0 degrees C. When the salt dissolves more of the ice cube, the solution gets more dilute which will increase the freezing point slightly. As the water's temperature is increased and falls then below 0 degrees C it will freeze again. This attaches the string to the ice cube. When making homemade ice cream, crushed ice and salt are mixed in the ice cream maker to lower the temperature below the freezing point of water.

A real life application is obviously snow and ice removal on streets with salt and making ice cream at home.

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Demonstrations by Andrew Huntsman

Physics Major

#15. LIVE WIRE OR MEMORY WIRE

Materials: Nitinol Wire (Available from Flinn Scientific Inc. ≈ $1.20/inch)

Pot of cold water

Pot of hot water

Procedure: -Place the wire in the pot of cold water and bend into any shape you wish.

-Place the bent wire into the Hot water pot and watch the wire go back to its original structure.

Explanation: The wire has a specific crystal structure of all of it molecules, and when the wire is heated the molecules can move easier into its original shape.

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<u>Demonstration by Jennifer VanGundy</u>
<u>Earth Science Major</u>

#18. MAGIC SAND

Materials: Magic Sand (available commercially in toy stores). Might try spraying very fine sand with some "Scotch Guard" or "Teflon".

Procedure: 1. Fill a cup 3/4 full with water.
2. Slowly pour Magic Sand in a continuous stream into the water. Look closely at the sand. What is that silver-like coating on the sand?
3. Pour off the water from the sand into a second container. Let them touch the sand and see what they find. To everyone's amazement, the sand is completely dry!

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#26. MAGIC MATCH

Materials: -Matches

-Matchbox

Procedure: First, explain that there is a difference between physical and chemical changes. The magic match can show both of these changes. Break the match in half. Explain why this is a physical change. Following the break, light the match. Explain why this is a chemical change.

Purpose: This is another quick engagement activity to introduce the difference between physical and chemical changes. It can also be implemented in an earth science course explaining the difference between mechanical and chemical weathering. When the match is broken, its physical properties changes, but its chemical properties remain the same. After the sulfur on the match is ignited with help of potassium chlorate (oxygen), the wood is burned and undergoes a chemical change. The match is now a different substance.

`

Demonstrations by Whitney Kastner

Biology Major

#27. ACIDS AND BASES

Scientific Principles: Acids and Bases, pH

Materials: Head of Red Cabbage (chopped)

Various acidic and basic solutions

Examples:

Milk of Magnesia

Lemon juice

Distilled water

Baking soda

Milk

Orange juice

Let the kids choose some too!

4-6 mason jars, these must be transparent so the students can see what is happening

Procedure: 1. Chop up the head of red cabbage and let it soak, in a pot of hot water, for a couple of hours. (Probably ought to do this step before coming to class).

2.Pour the reddish purple soup into the mason jars.

3. Add basic or acidic substances to make the color of the “soup” change colors, red/pink for acidic substances and blue for basic items.

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Demonstrations by Jack McCloud

Additional Baccalaureate - Biology

"Boiling Water with Ice"

Scientific Principles:

- States of Matter
- How heat and pressure can affect the states of matter

Materials:

- Pyrex flask – 500ml or larger, with rubber stopper
- Heating unit (Bunsen burner or heat plate)
- Heavy duty safety gloves
- Water
- Ice in strong zip-lock bags (2)

Procedure:

- Heat approximately 200 ml of water in flask over heat. Boil for a couple of minutes.
- Using gloves, take flask off heat, wait 5 seconds and cap with rubber stopper (firmly).
- Turn off heat.
- Place flask on sturdy surface for class to see, using a safety glass is highly recommended.
- Wait for flask to cool enough so it is clearly not boiling anymore from the heat (30 seconds).
- Turn flask upside-down and place bags of ice on the sides of the flask. As the steam inside cools, a mini-vacuum is created and water will start boiling due to lack of pressure on top of it.

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Demonstrations by Brad Burk

Senior – Biology

"Jumping egg"

Scientific principles:

The egg leaped out of the glass due to an updraft of air pressure created by blowing into the cup at an angle. Because of the angle at which you blew into the cup, the air flowing over the egg formed an area of low air pressure, which caused the egg to move upward into the air in the room. The air current from the cup met the air current in the room and caused a low pressure flow, which, in turn, caused the egg to travel downward into the second glass.

Materials:

Two shot glasses
One large egg

Procedure:

Place the egg in one of the glass and then place that glass on a smooth surface (table top). Place the second glass next to first leaving little if no space between the two. With great force, blow directly down on the egg and move it from one glass to another.

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Demonstrations by Adam McBride

Senior – Chemistry

"(Safe) Thermite Reaction"

Scientific principles:

-Redox reactions

-energy associated with exothermic reactions

Materials

-two rusty iron spheres

-aluminum foil

Procedure

-Bang the two spheres together w/o the foil to demonstrate that nothing happens -wrap the two spheres with the aluminum foil -bang together again, there will be a loud popping noise and (in a darkened room) a visible spark -show the class that at the point of impact, the sphere no longer contains rust and the aluminum has been oxidized.

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Demonstrations by Brenna Haley

Senior – Chemistry

"Frozen Tight"

Put approximately 20g of barium hydroxide [$Ba(OH)_2$ * $8H_2O$] crystals in a 50mL beaker. Add any of the following (ammonium thiocyanate 10g, ammonium chloride 7g, ammonium nitrate 10g). Stir the two solids together with a wooden splint. Place the beaker on a small wooden block with a small pool of water between the beaker and the block. After a few minutes the beaker will freeze to the block.

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Demonstrations by Sandra Macklin

Senior Biology

"A Piercing Experience"

Materials:

A 10 or 12 inch balloon for each participant
A bamboo skewer 10 -12 inches long

Description:

Inflate a balloon to about 6 inches.
Gently twist and push the skewer through the thick nipple end of the balloon, until it penetrates the surface of the balloon
Continue to twist and push until the skewer penetrates the knot end of the balloon.

Background information:

Balloons are made of thin sheets of rubber latex, which are made from many long intertwined strands of polymer molecules. The rubber is stretchy because of the elasticity of the polymer chains. A sharp, lubricated object (bamboo skewers have a natural lubrication) can be pushed through tie and nipple ends of the balloon because the polymer strands will stretch around it.

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"Fire and Ice"

Supplies:

Sodium Perioxide (Na_2O_2)

Fire proof container

Fuel (shredded paper, sawdust, etc)

Small piece of ice

Fire extinguisher for safety

Caution: Make sure you read the MSDS on Na_2O_2 before using it.

Na_2O_2 is a hazardous substance and must be used properly.

Procedure:

Place the fuel in a pile about 2-3 inches high in the fire proof container.

Sprinkle about ½ teaspoon of Na_2O_2 on the fuel.

Tell the students you want to start a fire and all you have is a piece of ice. Ask them how you could use the ice to start a fire. After discussing it for awhile place the piece of ice on top of the pile. Watch the fire start. Have a fire extinguisher hand in case of mishap.

Discuss what just happened with the students.

What happened?

How did it happen?

What did the Na_2O_2 do?

What reaction occurred?

Was the reaction exothermic or endothermic?

Why was shredded paper or sawdust used instead of a whole piece of paper or wood?

Reaction:

$Na_2O_2 + H_2O \rightarrow 2NaOH + O + Heat$

As the ice melted the water combined with the sodium peroxide and released atomic oxygen and heat. The atomic oxygen is highly reactive and this and the heat released from the exothermic reaction started the fire. Shredded paper or sawdust was used to increase the surface area and make the fire easier to start.

See "Invitations to Science Inquiry" by Tik Liem for additional information.

Demonstrations by Sarah Larcher

Senior - Biology

"Traffic Light Reaction"

Upon stirring then shaking a solution, you will see the colors of a traffic light!

Directions:

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Mix Two Solutions: A=0.6g Dextrose +1g NaOH in 50ml DI water

B=0.1g Indigo carmine indicator in 9.9 ml DI water

Mix A+B in a 250ml Flask with a rubber stopper,

Allow some time for the reaction to settle, it is ready when it is yellow. When it is ready gently swirl the solution and you should get a red color, shake it violently and green color should appear! Upon sitting, the solution will turn back to yellow; this reaction can be repeated for over an hour.

WHY????

Redox reactions (oxidation/reduction) of a chromophore, in this case indigo carmine.

The alkaline dextrose reduces the indicator and turns it yellow, swirling adds oxygen and oxidizes the solution to red, shaking oxidizing it even more and turns the solution red. Upon sitting the alkaline dextrose reduces the solution back to yellow.

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<u>Demonstrations by Shari Schneider</u>

Senior - Chemistry

"Boiling Butane"

Take any kind of butane (I just used a refill bottle for lighters purchased at the hardware store) and place it in a zip-lock baggie. Then just touch the baggie and you will see the butane boil. The sack will begin to fill with butane so you don't want to put too much butane in the baggie otherwise the sack will pop.

This demo can be explain by the fact that butane has such a low boiling point (0.5C) This is also an endothermic reaction because the baggie gets cold because the butane is absorbing the heat. Likewise,

when you touch the baggie the butane absorbs the heat from your hand which is higher then the boiling point. Therefore the butane will boil.

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THE FIREPROOF BALLOON

Emily McHugh - IDLA-Chemistry Concentration - Elementary

Materials: -Two Balloons

-Matches

-Water

Procedure: Inflate one of the balloons and tie it shut. Take the other balloon and fill it with ¼ cup of water, then inflate the balloon. Take the first balloon and light a match underneath it. The balloon will blow up. Take the second balloon with water in it and light a match under that balloon. This balloon should not explode.

Purpose: This experiment shows how water is a good absorber of heat. When heated, the rubber of the first balloon becomes hot and very soon it can not resist the pressure of the air inside the balloon. The second balloon does not blow up because water absorbs most of the heat away from the plastic of the balloon. Therefore, the balloon does not break.

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THE IMPLODING CAN

Emily McHugh - IDLA-Chemistry Concentration - Elementary

Materials: -One soda can

-Shallow, clear dish

-Hot plate

-Water

-Tongs

Procedure: Fill a pop can with a small amount of water, place it can on top of the hot plate and bring water to a boil. Fill the shallow dish with cold water. Once the water comes to a boil, flip the can immediately into the dish of cold water. The can should crush once it hits the cold water.

Purpose: As the water inside the can begins to boil, the water vapor replaces the air inside the can. When the can is inverted into the cold water, the temperature drops suddenly. The temperature decrease changes the evaporation phase to the condensation phase, meaning an abrupt decrease in pressure. As a new equilibrium is trying to be reached, the can will shrink.

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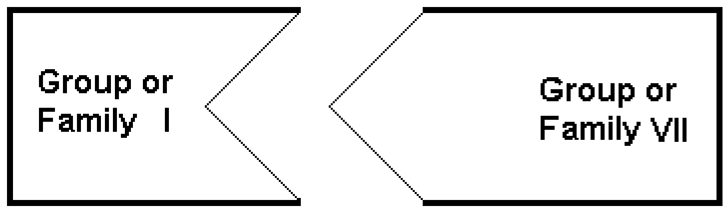
CHEMICAL COMPOUNDS AND THE PERIODIC TABLE

Andrea Lambrecht - IDLA-Chemistry Concentration - Elementary

BACKGROUND INFORMATION: The periodic table is a chart in which elements having similar chemical and physical properties are grouped together. Elements are arranged by atomic number in horizontal rows called periods and in vertical columns known as groups or families, according to similarities in their chemical properties. The elements can be divided into three categories – metals, nonmetals, and metalloids. A metal is a good conductor of heat and electricity, while a nonmetal is usually a poor conductor of heat and electricity. A metalloid has properties that are intermediate between those of metals and nonmetals. A compound is made up of two or more elements. The periodic table correlates the properties of the elements in a systematic way and helps us to make predictions about chemical behaviors.

An atom can lose or gain more than one electron. A positive ion is known as a cation. The formation of a cation is a result of the loss of one or more electrons. On the other hand, an anion is an ion whose net charge is negative due to an increase in the number of electrons.

DIRECTIONS: Cut out the atom examples you have been provided. You should cut the triangles out from inside the blocks for Groups I, II, and III. For Groups V, VI, and VII, the triangles should be left on the outside of the blocks. Therefore, you should end up with a set that has blocks with triangles missing and a set that has blocks with triangles added. The blocks with missing triangles represent metals. While the blocks with added triangles represent nonmetals.



EXAMPLE: Sodium (Na^+)is a metal in group I and chlorine (Cl^-) is a nonmetal from group VII. Due to the fact that different electrical charges attract, the positive sodium is attracted to the negative chlorine and the chemical compound sodium chloride is formed. Therefore, the formula NaCl represents the compound because there is one sodium and one chlorine. On the other hand, if chlorine (group VII) were to combine magnesium (group II), the magnesium would lose two electrons while the chlorine would only gain one, as a result there would have to be 2 chlorines for each magnesium. The formula for this compound would be $MgCL_2$. Usually, the positive atom is listed first and the negative atom is listed second.

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NON-BURNING MONEY

Sara Cleaves - Earth Science Concentration - IDLA (Elementary Teacher)

Materials: A dollar bill, lighter or match, 100mL of rubbing alcohol, and 50mL of water.

Set-up: Mix the rubbing alcohol and the water together and soak the dollar bill in it. Light the dollar bill on fire.

Science: As you will see, the bill lights on fire but does not burn. The part that is burning is actually the alcohol on the bill. The bill has enough water on it that it does not burn when the alcohol is burning.

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FLOATING PAPER CLIP

Erica Engels – Earth Sciences

(Found on nerds.unl.edu)

Objective: To show surface tension.

Materials: 1 paper clip, container of water, and bottle of dish soap.

Procedure: Take a clear container and fill it with water. Carefully take the paper clip and place it in the water so that it floats. It may take a few tries to get the paper clip level enough that it will float. Discuss why the paper clip is floating with the class. Then add a drop of dish soap and watch the paper clip fall to the bottom of the container.

Explanation: This experiment is an example of the surface tension of water. The attraction of the water molecules creates almost a skin like surface. Adding the soap then disrupts the attraction of the water molecules and makes the paper clip fall.

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LIQUID NITROGEN EXPERIMENTS

Travis Stinar - Physics

Materials: Liquid Nitrogen, a bowl or cooler for liquid nitrogen, tongs, red and blue balloons, aluminum can, a lighter and a splint of wood.

Procedure: Experiment 1 – Fill the aluminum can half way with liquid nitrogen, set aside. Light splint of wood. When the can starts “sweating” place splint against liquid on outside of aluminum can. Careful splint will start on fire.

Experiment 2 – Place liquid nitrogen in bottom of bowl, enough to cover bottom. Before the demo, place blue balloon filled with air in bowl, let shrink. At demo show audience red balloon place in bowl and remove blue balloon. Ask why and then tell them the joke.

Explanations: The first experiment is neat, and can be useful explaining changes in states of matter, and can help show that liquid nitrogen is extremely cold. The liquid that collects on the outside of the can is not water, but actually liquid oxygen. The audience will suspect that the splint will not catch on fire, because they think it is water on the side of the can. However, it catches on fire because liquid oxygen is flammable. The other experiments are great examples of changes in states of matter, and shows that molecules slow down at cooler temperatures. Both the balloons will appear to contract, however, as we all know the size of the molecule doesn’t change. The molecules just don’t move as far, lowering the pressure in the balloon. If you shake the balloons you can hear them rattle, this is the water vapor that was present in the balloon and has frozen. You can do this with various other objects, to show changes in states of matter.

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Egg in Milk Bottle

Greg Dunn - Biology

Materials: One glass milk jar, matches/lighter, a strip of paper 3cm x 10cm and one peeled hard boiled egg.

Procedure: Demonstrate that the hard boiled egg does not fit through the opening in the bottle. Next take the piece of paper and light it on fire. Drop the paper into the bottle and allow it to burn out. Place the egg on the opening and watch for the egg to fall into the bottle.

Science: The principle of the experiment has to do with hot air increasing pressure, thereby forcing gases out of the bottle, and then, once the burning paper is out, a quick change in temperature resulting in a lower pressure inside the bottle pulls the egg into the bottle.

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THE CAN RIPPER

James De Pue - Biology

Demonstration at a glance:

An empty soda can be easily ripped clean in two. This can be used to impress possibly hostile students on the first day of class??

Set-up:

Remove the tab off an empty clean soda can. With a screwdriver or other sharp object "scratch" a circle around the inside middle of the soda can. Pour in a solution of copper (II) chloride to a depth up to the scratch and let sit for a few minutes. Pour out the copper (II) chloride solution and rinse the can. It is now ready for ripping.

Theory:

The need for the scratch around the inside of the can is due to the fact that soda cans contain a plastic lining which protects the can from the acidic soda. The copper chloride solution is involved in a single replacement reaction with the aluminum in the can as follows:

$3CuCl_2$ (aq) + 2Al (s) > $3AlCl_3$ (aq) + 3Cu (s)

After the reaction, the can is basically being held together by the outside paint and a thin film of copper.

Extension:

The presence of a plastic lining has impressed my students for years. To see it more effectively, place a soda can full of water in a strong solution of HCl and the aluminum will be dissolved leaving the plastic lining and what's left of the can. This should be done under a fume hood or in a well ventilated area away from students as a lot of vapor is given off and a lot of heat produced (thus the need for water to prevent the lining from melting.)

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ELEPHANT TOOTHPASTE

James De Pue - Biology

Procedure

1) Put on the safety goggles and gloves.
2) Use the scissors to cut one of the garbage bags down one side and across the bottom. Open the bag and spread it over the demonstration area. Save the remaining bag for cleanup.
3) Place the graduated cylinder on the open bag.
4) Fill the cylinder to about ¼ full with 30% hydrogen peroxide.
5) Add from 5 mL to 10 mL liquid soap or dishwashing liquid.
6) Sprinkle some food coloring on the inside wall of the cylinder.
7) Add 10 mL saturated potassium iodide solution.
8) STAND BACK! In a few seconds a column of foam will rise out of the cylinder and overflow onto the open bag.
9) Use the recommended safety equipment and observe safe handling practices when working with 30% hydrogen peroxide. It is a strong oxidizer.
10) Note: To prepare the saturated solution of potassium iodide, dissolve 100 g of potassium iodide in 70 mL of water. You can prepare this solution ahead of time and store it for future use.

Explanation

This activity demonstrates the decomposition of hydrogen peroxide catalyzed by potassium iodide. The rapid production of oxygen causes the mixture to foam, rise, and overflow the cylinder. The 2-step decomposition reaction is written as follows:

a. $H_2O_{2(aq)} + I^-_{(aq)} \rightarrow H_2O_l + OI^-_{(aq)}$ (rate determining step)

b. $H_2O_{2(aq)} + OI^-_{(aq)} \rightarrow H_2O_l + O_{2(g)} + I^-_{(aq)}$

You can reveal the presence of oxygen in the foam by performing a glowing splint test. Place a glowing splint in the foam and it will relight, indicating that oxygen is present. Do not drop the splint into the cylinder. The brown color of the foam indicates that iodine is present. Iodine can stain clothing and skin, so avoid contact with the foam. This demonstration is a fun, attention-getting way to introduce topics such as kinetics, rate laws, decomposition, oxidation/reduction, and gas production or limiting reagents.

Cleanup

Rinse the cylinder with water and set it aside to dry. Place the foam and open bag inside the remaining bag and discard.

Materials

- 50 mL to 100 mL 30% hydrogen peroxide
- 10 mL saturated potassium iodide solution
- 10 mL liquid soap or dishwashing liquid
- food coloring
- 2 plastic garbage bags (large size)
- a graduated cylinder (500 mL or larger, glass is preferable to plastic)
- a pair of scissors
- a pair of safety goggles
- a pair of rubber gloves

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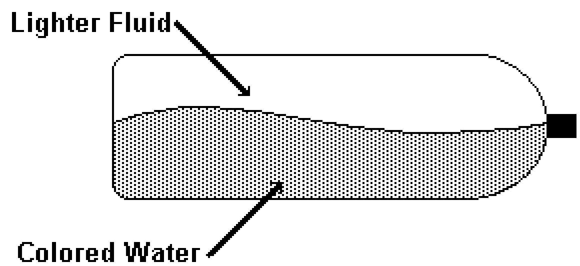
Waves in a Bottle **Jayne Shumaker**

Procedure: Fill half of a one liter plastic bottle with distilled water.
Add 50 ml of ethyl alcohol.
Add charcoal lighter fluid to fill the bottle to the brim.
Add four drops of blue food coloring, one at a time.
Place the lid on the bottle and seal it with tape.
Turn the bottle on its side and rock it for to aft to produce waves.

Explanations: This is similar to a number of commercial devices. The waves appear to be in slow motion because the density of the clear lighter fluid is much closer to the density of the blue water than the density of air. The increased inertia of the lighter fluid makes it much more difficult to move that air which is normally found above a water surface.



Water molecules are polar. Charcoal lighter fluid is non-polar and less dense than water. Thus, the lighter fluid will float on top of the more dense water. The food coloring is a polar solution so it will drop through the non-polar lighter fluid without dissolving (like dissolves like). When it reaches the water it quickly dissolves in the polar water coloring it all blue.

CAUTION: The lighter fluid is very flammable. Keep away from all sources of ignition.

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Chemical Sunset **Jayne Shumaker**

Procedure: Cut a hole the size of a Petri dish in a piece of cardboard large enough to cover the top of an overhead.

Place the Petri dish in the hole.

Add enough $Na_2S_2O_3$ to cover the bottom of the dish.

Add about 5 ml of concentrated HCl and quickly stir the solution.

(Wear gloves and a face shield when you use hydrochloric acid).

Observe the color changes.

Explanations: The reaction produces colloidal sulfur that scatters light as it is being formed and produces different colors. A natural sunset is observed when light is scattered by dust particles in the atmosphere.

Solutions: The sodium thiosulfate pentahydrate solution, $Na_2S_2O_3 \cdot 5H_2O$ is 0.03 M: Dissolve 7g per liter of water.

The hydrochloric acid is concentrated.

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Sinking Ice

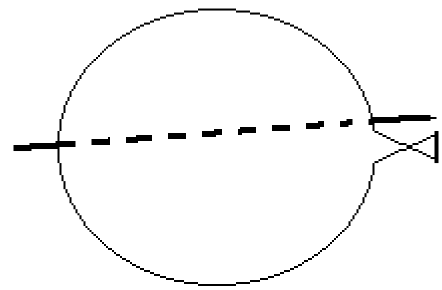
Guinevere Kulyan

Materials: Ice colored with food coloring, a glass or plastic container, rubbing alcohol.

Procedure: Ice is less dense than liquid water, thus it floats in water. However, what if ice was denser than liquid water (which is that case in other materials)? Ice sinks in alcohol. Make ice with food coloring in it so that student will be able to see the ice as it sinks. Place the ice into a container of alcohol and watch as it sinks.

Magic Polymer Balloon **Ted Clapp**

In this demonstration a bamboo skewer pierces an ordinary, inflated balloon. You will need nothing more than a high quality helium grade balloon, a bamboo skewer (or long needle), and cooking oil. After inflating your balloon try pushing the bamboo skewer through near the tip and back out near the opening. If everything worked then you will notice the balloon did not pop when it was pierced at either end. If you are having trouble making this work then try coating the skewer with cooking oil for lubrication.



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Non-Burning Dollar Bill **Ted Clapp**

Fire is always an eye catcher when doing a demonstration. The non-burning dollar bill is no exception, however, it would be prudent to warn students not to try this at home just as a precautionary measure. In this demonstration you will need a solution of two parts alcohol and one part water. You may want to add a bit of NaCl to the alcohol in order to make the flame more visible to your audience. Simply soak the dollar bill in the mixture and hold it to a flame. Because of waters ability to withstand heat the dollar bill is protected from the flame as the alcohol is burned off.

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Colors of "MOM" **Ted Clapp**

In this demonstration Phillips Milk of Magnesia (MOM) is used to help show the changes that occur as a solution changes pH. Start with about 300ml of water in a beaker with a magnetic stirrer. If a magnetic stirrer is not available then be sure to stir continuously throughout the rest of the demo. Add about twenty drops of universal indicator and a few tablets of MOM. Your solution should turn a cloudy purple. Add a few drops of one molar HCl to the beaker until the solution goes to red. You will notice that the solution goes through the color spectrum all the way back to purple. This is because the basic MOM in the solution is neutralizing the acid and the pH is retuning to where it started.

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Balloon Races **Lee Harrison**

Purpose: To demonstrate the affects that heat has on a chemical reaction.

Materials:

1) Three medium sized balloons,

2) Three tablets of Alka Seltzer ™,

3) Three Elymerer Flasks,

4) Hot Plate

Procedures: Fill the flasks one quarter full of water. Place one flask in a refrigerated environment, another flask leave at room temperature, and place the third flask on the hot plate at medium heat. Put the crushed Alka Seltzer ™ in the balloons, (one tablet per balloon). Wrap the mouth of the balloon around the opening of the flask. Make sure that the crushed substance in the balloons does not fall into the flask. When all the balloons are attached to the flasks, find two volunteers and simultaneously lift the balloons so that the crushed substance falls into the flasks and observe.

Findings: The balloon attached to the heated flask expanded quickest due to the heated reactions. The flask at room temperature comes in a close second, and the chilled flask is a distant third.

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The Balloon that Can Take the Heat **Lee Harrison**

Purpose: To demonstrate the heat capacity of water.

Materials:

1) Two medium sized balloons,
2) Matches or lighter.

Procedures: Blow one balloon up and tie off the end. Fill the other balloon with water, (enough to fill the lower bottom of the balloon). Light the match or lighter and place the balloon without water, directly over the flame. The balloon will pop immediately. Now, place the balloon with the water over the open flame and the balloon will not pop immediately.

Findings: The water in the second balloon will absorb the heat of the open flame and extend the integrity of the balloon surface.

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MOLECULAR MOTION

One of my favorite demos is one of the simplest of all but demonstrates a very abstract concept. While nearly everyone is familiar with the concept of temperature, few people really understand that it is directly related to the microscopic motion of the molecules. The hotter something is, the faster the molecules of the material are moving. In fact, by knowing the temperature and the substance, it is possible to calculate the average speed of the substance's molecules. This is a very difficult concept to teach because it is not possible to directly observe molecules in a classroom. However, a demonstration that shows the results of different molecular speeds at different temperatures is very simple to perform. Simply fill two 400 ml beakers, one with hot water the other with cold water. Drop in about two drops of food coloring in each beaker and observe. The food coloring in the cold water will usually just drop to the bottom and just sit there. It will disperse very slowly. The food coloring in the hot water will quickly begin to disperse and soon the entire beaker of water will be colored. This is because the faster moving molecules in the warm water knock the food coloring molecules around much quicker than the slow moving molecules in the cold water.

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1. Effect of pressure on the size of a balloon - Beth Kochevar

The purpose of this demo is to relate the ideal gas law to what the students observe. Start by clamping a 4 L filter flask to a ring stand. Blow up a balloon so the sides become rigid but it should still fit through the neck of the flask. Tie the balloon closed and insert into the flask. Seal the flask with the stopper and attach one piece of vacuum tubing to the flask. Connect the other end of the tubing to a stopcock a second piece of tubing the stopcock and an aspirator. Turn on the aspirator and slowly open the stopcock. The balloon will increase in size. When the stopcock is closed and unattached from the aspirator the balloon will shrink again. If this demo is done around Easter the marshmallows bunnies will work in place of the balloon but they will only work once because the air is not in the pockets of the marshmallow after it is deflated. Try to have the students relate their observations to the ideal gas law and determine what is changing and what variables are remaining constant.

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2. Investigating Limiting Reactants - Mica Deike

Materials Needed:

Household vinegar (5% acetic acid, HC2H3O2), 100mL
Sodium bicarbonate, NaHCO3 (baking soda), 5g
Funnel
5 party balloons, 12” round
5 Test-tubes, 18 x 150 mm

Procedure:

1. Add 11.5 mL of 5% household vinegar to each of the six test tubes.
2. Add the following amounts of baking soda to the five 12" party balloons: 0.2g, 0.4g, 0.8g, 1.6g, and 3.6g
3. Make sure the baking soda is sitting on the bottom of the balloon and not near the opening of the balloon.
4. Attach the five balloons to the five test tubes containing vinegar. Make sure the contents of the balloon do not mix with contents of the test tubes and that all the air has been squeezed out of the balloons.
5. After all the balloons are securely fastened to the test tubes, one at a time lift the balloons allowing mixing of the balloon and test tubes contents.
6. Record observations of each test in the table in the inquiry section.

Results:

The first three balloons should increase in size as more baking soda is added to the vinegar. However the last two will end up about the same size as the middle balloon. While the first three test tubes should only contain a clear liquid when finished, the last two balloons should have a lot of undissolved baking soda. The first two test tubes are limited in their reaction by the amount of baking soda present while the last two are limited by the amount of vinegar present. In this demo, only the middle test tube contains exactly the right amount of baking soda to react with all the vinegar so that there is no unreacted material of any kind present at the end.

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6. Magic "Floating" Coin - Ryan Evans

Take a coin made of aluminum, such as a Chinese 1 yen coin, and rest it on the surface of the water. You can use a bent paper clip or a fork to carefully place the coin on the water's surface. It is held there by the surface tension of the water. This tension is caused by the polar hydrogen bonds between water molecules and is similar to an elastic rubber membrane or balloon. If you look closely you can see the "skin" bending, and sagging under the weight of the coin.

Next, try to rest a coin with a thin film of soap on it. This task should be more difficult because soap breaks down the surface tension of the water. This demonstrates why we use soap for washing. It allows water to get into the cracks and surround dirt particles so they can be washed away.

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7. The Egg Trick - Steve Ottmer

Concepts:
convection and air pressure

Materials:
wide mouth glass bottle, candle, matches and a hard boiled peeled egg.

Method:
Place the candle inside the bottle and light it with a burning piece of paper. Place the egg lightly over the top of the bottle. The air inside of the bottle is heated from the candle, thus making it expand and pass over the outside of the egg. Eventually the fire will extinguish itself because all the oxygen is used up and all that is left is carbon dioxide. Once the flame goes out the temperature will cool thus creating a lower air pressure inside of the bottle. This increase in temperature pulls the egg into the bottle.

To get the egg out, turn the bottle upside down so the egg is at the mouth. Cool the bottle slowly then invert the bottle in a warm temperature bath. The change in temperature changes the pressure again thus pushing the egg back out. Or if you don't mind a little egg on your face, blow hard into the bottle while you hold it upside down.

Warning:
After repeated attempts the bottle may eventually break!

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8. What Happens When Air Is Heated - Mishon Reps

Materials:
A yard stick, paper lunch bags, a folding chair, masking tape, a candle, and matches.

Procedure:
Tape a paper bag to each end of the yard stick on the same side(facing down). Then, balance the yard stick on the back of the chair like a teeter-totter. When it is completely balanced, light the candle and place it under one bag. The yard stick will then teeter (go down) on the cooler side because the bag with the candle under it will act like a hot air balloon. Hot air is lighter than cool air, because it has less mass per unit volume. The gas laws dealing with temperature and volume explain the affect on density of a gas when conditions are changed.

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9. Endothermic and Exothermic Reactions - Jeff Stephens

Chemical changes are usually accompanied by a change in heat. If heat is absorbed in a reaction, the reaction is said to be endothermic. The products are higher in heat content than the reactants. A reaction in which heat is given off is exothermic. In this case, the products are lower in heat than the reactants. The amount the temperature increases or decreases in a given reaction can be measured by placing a thermometer in the reaction vessel.

This experiment uses a half a cup of Ammonium Nitrate (NH_4NO_3) and a half a cup of Calcium Chloride ($CaCl_2$). They are in plastic Ziploc bags and are mixed with a half a cup of water. When mixed with water one will release hit and the other becomes cold, absorbing heat.

The majority of students should be familiar with instant cold packs and heat packs. Most students have seen the heat packs or cold packs that instantly turn cold or hot.

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Carrie Alexander

5. HOW DID SCIENCTISTS DISCOVER ATOMIC STRUCTURE?

Take small toys that have some detail on them and place them, each in a bag. Get students into groups of three, and assign each student a role. One student will be the feeler, another student the recorder, and the third student will be the artist. The first student places his/her hand in the bag and feels around, while they are doing this they verbally describe what they are feeling. The reporter writes down the descriptions. Last, the artist draws their rendition of what the object in the bag looks like. This exercise demonstrates how scientists had to work together in order to discover atomic structure or anything that is smaller than the human eye can detect or things too large for one person to study. Students can use this demonstration to help understand the scientific process and understand why it is so important to work cooperatively.

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AN EXOTHERMIC REACTION

Grade level: General Chemistry - Junior-Senior level

Standards related to topic: This demonstration relates to Standard 2.1,2.2 and 2.3. It show that the matter involved has characteristic properties and that the reaction taking place are a result or the composition and structure. They will also see how the energy of the system can be changed into heat.

Chemical Reaction.

Materials - cost $5 to $8 dollars Thermometer, A jar and lid ,. A Steel wool Pad,. Vinegar

Time: 25 minutes

Experiment

1. Put the thermometer inside the jar and put the lid on it. Wait five minutes.

2. Remove the thermometer from the jar. Record the temperature.

3. Pour the vinegar over the steel wool and let set for one minute. Squeeze out the excess vinegar. Then place the steel wool over the bulb of the thermometer and place back into the jar, put on the lid.

4. Wait 5 minutes.

5. Now take the temperature.

Science behind the reaction: This is a classic example of oxidation. The steel wool is being oxidized by the vinegar. This reaction gives off energy in the form of heat.

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DEMONSTRATE THE GASES PRODUCED IN CHEMICAL REACTIONS

Grade level: General Chemistry- Junior-Senior level.

Standard: The standards covered by this demonstration are 2.1, 2.2 and 2.3. This will show the students that interactions can produce changes in a system.

<u>Home made fire extinguisher</u>

Materials – cost $8 - $15 Small dish, 1 or 2 candles (of different heights), Large metal bowl, Baking soda approx. 1/4 cup, Vinegar approx. 2 cups

Preparation

1. Put the baking soda on the small dish.

2. Place the candles on the small dish, in the baking soda.

3. Place the small dish with the candles on it into the large metal bowel.

Experiment

1. Light the candles.

2. Then pour the vinegar onto the baking soda, DO NOT get the candles wet.

Safety tips: Be careful of the fire and do not let the vinegar and baking soda reaction get out of hand.

Science behind the demonstration: The reaction between the baking soda and vinegar gives off Carbon dioxide. As the CO_2 rises, it consumes the Oxygen and put out the fire in the shorter candle. As the heavier CO_2 rises even more it will extinguish the taller candle.

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Jennifer Mathews

VISULATION OF pH

Grade Level: 9-12

Colorado Standard: 3.0

Materials: Galaxy Gold paper from Kinkos, Windex, vinegar/lemon juice

Directions: Office supply stores and Kinko's copy centers sell a type of paper called Astrobrights™ Galaxy Gold. It's "goldenrod" in color, sort of a yellow/orange. Big deal! However, if ALKALINE SUBSTANCES HIT IT, IT TURNS MAGENTA! Spray it with Windex, and it instantly turns bright red! Cool!!

Astrobrights Galaxy Gold paper is the worlds' largest acid/base indicator strip. Dip it in a base solution (like ammonia cleaner, baking soda in water, etc.) and it turns bright red. Dip it in acid (vinegar, lemon juice, etc.) and it turns yellow again.

The fact that an 8.5 x 11 sheet of goldenrod is enormously larger than your typical acid/base test strip makes numerous classroom demonstrations possible that never could be done before.

This demonstration would be useful when talking about pH and cells. I would also talk about buffers and living organisms.

(William J.Beaty, 1996)

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Deanna Schrock

13. BALLOON RACES

Topic: How temperature affects molecular movement, thus causing reactions.
Purpose: To investigate how temperature affects the rate of a reaction.
Grade Levels: 9-12
Standards: 2.1 - Students know that matter has characteristic properties, which are related to its composition and structure, using word and chemical equations; 2.2 – Energy appears in different forms, can be transferred, and transformed; 2.3 - Interactions can produce changes in a system, yet total quantities of matter and energy remain unchanged.
Materials: 3 medium-sized balloons; 3-250 mL Erlenmeyer Flasks; 15 g Sodium Bicarbonate (NaHCO31 (or 4 Alka Seltzer tablets crushed with a mortar and pestle); 90 mL Distilled Water; Ice Bath; 3 Thermometers; Hot Plate; Scoopula; Stopwatches; Balance; 50 mL Graduated Cylinder; I Long-stem Funnel
Directions: (5-10 min)

1 . Stretch out 3 medium-sized balloons by inflating them and then releasing the air about 5 times. This promotes inflation during the reaction. NOTE: Make sure the balloons will fit over the flasks.

2. Measure 3 separate 5 g samples of sodium bicarbonate and pour into each of the 3 balloons. Be careful not to drop any of the NaHCO3 into the flasks at this time.

3. Pour 30 mL of distilled water into the three flasks, then do the following:
   A. Cool the first flask to 0 to 5 degrees Celsius.
   B. Leave the second flask at room temperature.
   C. Heat the third flask to 85 to 90 degrees Celsius with a hot plate.

4. Ask for 3 volunteers, who will place a balloon over one of the flasks. Do not allow the sodium bicarbonate to drop into the flask at this time. While the balloons are being attached to the flasks, have the class record the temperatures.

5. Each volunteer will simultaneously shake the sodium bicarbonate from each balloon into the flask. Observe.

6. Have timers in the room record the rates at which the balloons inflate. Stop the watches when the gas stops bubbling in the flasks. Graph Temperature vs. Time.

7. Pour the solution waste down the drain, flushing with copious amounts of water.

Hazards: Wear goggles.
Science Behind the Demo: In order for reactions to occur, two things need to happen. First, the molecules have to hit each other with a certain amount of energy. Second, the molecules have to hit each other at the correct angle. If both of these criteria are

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not met, the reaction may not occur. When heating any reaction, the amount of energy increases in the molecules, causing the molecules to speed up. This will cause the molecules to collide with each other at a more frequent rate, thus increasing the chances that the molecules will collide with each other with the correct amount of energy and at the correct angle.

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Deanna Schrock

14. BLOWING UP A BALLOON IN A FLASK

Topic: Air Pressure

Purpose: To demonstrate air pressure by observing the properties of gases in the air when heated.

Grade Levels: 9-12

Standards: 2.1 - Students know that matter has characteristic properties, which are related to its composition and structure, using word and chemical equations; 2.2 – Energy appears in different forms, can be transferred, and transformed; 2.3 - Interactions can produce changes in a system, yet total quantities of matter and energy remain unchanged.

Materials: 8-inch balloons, 1-500 ml Florence Flask, Tongs (or gloves) for holding the flask Hot Plate, Water, Graduated Cylinder

Directions: (15-30 min)

1 . Place 10 mL of water into the 500 mL flask and heat the water until almost all of it is boiled off.

2. Remove the flask from the heat and place a balloon over the top of the flask as soon as the water stops boiling.

3 Place the flask into a container of cool water.

4. Observe the results. The flask should be cool enough to handle so that students can observe the balloon is filled, but the opening at the top of the balloon is still not tied.

5 Ask the students how to get the balloon out of the flask (reheat the flask).

6. Materials may be reused.

Hazards: Wear safety goggles, use tongs (or gloves) for holding the flask.

Science Behind the Demo: Heating the water in the flask causes the molecules to spread out so that eventually the water becomes water vapor. When the water is no longer heated, these water vapor molecules condense and return to their liquid condition, leaving an area void of any molecules. This lack of molecules creates a vacuum which is immediately filled by air from the outside of the flask., thus filling the balloon inside the flask.

Catherine Bowles

25. MAKING A SILLY-PUTTY LIKE MATERIAL

Materials: Elmer's All-Purpose Glue, Stirring Rod (plastic or wooden), Borax (Boraxo Hand Soap can be used), Food coloring, Water, Paper towel, Cups (Plastic or Paper)

Pre-experiment preparation- Make a saturated solution of Borax and water. Just add the Borax to the water until no more dissolves.

Recommended:

- Use paper cups with 20 ml marks to save time in measurement. When mixing the Borax with the glue mixture, to allow the audience to see more, do so in a clear plastic cup.
- Use a plastic spoonful of Borax solution it is thoroughly equivalent to 5ml.
- Use a plastic knife or a wooden splint to mix.

Directions:

1. Use 20 ml of Elmer's all-purpose glue and mix with 20 ml of water. (***Physical Change***)
2. Add food coloring and pour into a clear plastic cup. Mix thoroughly. (***Physical Change***)
3. Add 5ml(spoonful) of Borax solution. Keep mixing as the solution thickens. (***Chemical Change***) Pull out putty with plastic ware and blot the excess liquid with paper towel. Remove from towel and enjoy!

*4. To make more putty simply add 5 more ml to remaining solution. May repeat until all of the Glue solution is gone.

Suggested questions:

Pull the putty slowly. What happens?
Pull the putty quickly. What happens?
How do the structures of the Glue and the Glue and Borax mixture relate to the results of the pull tests?

For AP Chemistry:

Discuss polymerization and bonding.
To make a larger mixture multiply by each of the ingredients.
Example: 60ml of Elmer's, 60 ml of Water and 15 ml of Borax

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Joe Mock

27. MAKING WATER RISE

Materials: Clear container, water, food coloring or other dye, candle, match, jar big enough to cover candle

Method: Either melt the candle into the container or place on a candle holder. Add dye to the water to make it colorful and easy to see. (This can be done before class to save time.) Add the water to the container with the candle. Light the candle and allow it to burn. Cover the candle with the jar. The jar must reach the bottom of the container without coming in contact with the candle. Condensation will form on the jar as the candle slowly extinguishes. After the flame goes out, the water in the container will slowly move up the inside of the jar.

Why it works. The heat from the candle causes the particles to move quicker in the jar than on the outside. This results in a decrease in the pressure inside the jar. With the decrease in pressure, the pressure exerted on the water from outside the jar pushes the water up into the jar.

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1. **DISAPPEARING INK (Amy Nachtigall)**
   In a beaker combine 50 mL of 95% ethyl alcohol, a few drops of thymolphthalein indicator, and just enough sodium hydroxide solution (a few drops of 1M NaOH) to produce a deep blue color. Put the solution in a squirt bottle and enjoy! When squirted on a piece of cloth the blue ink will gradually disappear. The reason the ink disappears is because the sodium hydroxide in the solution is a base. As carbon dioxide from the air dissolves into the solution it forms an acid which reacts with the base to form a more neutral solution. The indicator is blue when in a basic solution with a high pH but it loses its color when the pH drops below about 9.5 as the CO_2 makes the solution more and more acidic.

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PATRIOTIC DEMONSTRATION (Lance Mosness)

A single solution is added to three different indicators. When it is added the solutions will be red, white, & blue, respectively. This demonstration can be done in test tubes, beakers, or petri dishes. The primary solution added to each of the indicators is a combination of ammonium hydroxide (NH_4OH) and ammonium sulfate ($(NH_4)_2SO_4$). It is made by dissolving 3.5 ml of concentrated Ammonium Hydroxide and 3 grams of Ammonium Sulfate in 100 ml of Distilled Water. The red indicator is a phenolphthalein solution. It can be made by crushing 5 or 6 EXLAX tablets into a bottle of rubbing alcohol. About 3 drops are needed in the test tube. It turns red when it reacts with the basic Ammonium Hydroxide. The white is formed when the Ammonium Sulfate in the primary solution forms a precipitate with a Barium Chloride ($BaCl_2$) solution. The Barium Chloride solution is formed by dissolving about 5 grams in 10 ml of water. Only about 6 drops are needed. The blue color is formed by reacting the primary solution with a thymolphthalein solution. A few milliliters of thymolphthalein solution can probably be obtained from a local high school chemistry teacher. Only 3 drops are needed. The thymolphthalein turns from clear to blue when it reacts with the basic Ammonium Hydroxide.

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FUN WITH CO2 (ACID/BASE CHEMISTRY) (Michael David Kaiser)

In this demonstration a small piece of dry ice is added to a large graduated cylinder containing a weak basic solution and a few drops of universal indicator (purple cabbage juice can also be used). The basic solution can be made by filling the cylinder with water and adding a few drops of concentrated ammonia until a purple color is reached. This indicates that the solution is basic. Add a very small piece of dry ice to the cylinder. The solution will froth and turn from purple to blue to green to yellow etc. as the pH decreases. As the dry ice sublimes, carbonic acid is produced in the solution. The universal indicator indicates the change in pH as the solution changes from acidic to basic. This demonstration clearly shows students that dissolved gases can effect the pH of a solution in much the same way as an addition of acid or base to a solution. Dry ice is fun to observe but the same effects can be obtained by dropping in a couple of tablets of Alka-Seltzer.

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SUPER SATURATED SOLUTIONS (Karen James)
This will demonstrate the behavior of a super saturated solution, and show that things are not always what they seem. Gradually warm hydrated Sodium Acetate in a large flask until it dissolves into its own water of hydration before presenting the demo. To begin the demo, explain to students that the solution is super saturated Sodium Acetate. This means that the solution is at the very edge of staying a liquid (for younger students, explain that there is not any more room left in the solution for anymore molecules of Sodium Acetate, and that the solution doesn't want more molecules in with it). Then add one or two crystals of solid Sodium Acetate into the flask. The solution will rapidly solidify. Proceed to turn the flask upside-down, showing that the solution is now solid.

This demo can be used over and over. The super saturated solution can be returned to a liquid state by heating and can be stored at room temperature for the next time.

The reusable chemical hot packs available from drug stores work on exactly the same principles except they use a shock wave from a "clicker" to initiate the crystalization.

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SUNKEN ICE CUBES (Amy Nachtigall)

Kids tend to jump to conclusions when things appear to be identical. Fill one beaker with plain water. In another beaker, place alcohol (rubbing alcohol from the drug store is fine but any other alcohol will work). The beakers will look essentially identical. Place an ice cube in each beaker. The ice will float in the water because its density (about .9 g/cm3) is less than the density of water (about 1 g/cm3). The ice will sink in the alcohol because the density of the ice is more than the density of alcohol (about .8 g/cm3). This is a great demo to introduce density because it really surprises the students and gets them to think.

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CLOUD IN A JAR (Jocelyn Friedman)

This is a good demonstration to do while teaching a lesson on how clouds form. You will need a liter size soda bottle, wooden matches, and a fizz keeper top for a soda bottle from the grocery store. First, start by asking the students what is needed to make a cloud.

1. Water or moisture
2. Low pressure
3. Condensation Nuclei (smoke from the matches)

To begin the demonstration fill the bottom of the bottle with about 1/2 centimeter of water, put the fizz keeper lid on the bottle and pump to raise the pressure inside the bottle. Now unscrew the fizz keeper to release the pressure. Nothing will happen because only the first two ingredients were present; there were no condensation nuclei in the bottle.

Repeat the experiment but this time light a match, blow it out, then drop the smoking match into the bottle. Quickly put the fizz keeper lid on the bottle and again pump to raise the pressure. When the fizz keeper is unscrewed this time, a cloud should form due to the lowered pressure, moisture from the water, and condensation nuclei from the smoke. In order for the cloud to be easily seen, try to wear dark colored clothing. If you do not have a fizz keeper to increase and decrease the pressure in the bottle you can use your mouth instead. After you light the match drop it in the bottle, when it goes out put your mouth over the top of the bottle and blow into the bottle. This will increase the pressure. To decrease the pressure, quickly inhale

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PLASTER OF PARIS (Lance Mosness)
This demonstration is a spectacular precipitation reaction. The solutions need for this demo are a 2 molar concentration of Sulfuric Acid (H_2SO_4) and a 2 molar concentration of Calcium Chloride ($CaCl_2$). Take equal amounts of each and pour into a tall glass or beaker and stir for a second. Immediately a white solid precipitate is formed. Try turning the glass upside down, the solid precipitate remains in the glass. The 2 molar solution of Calcium Chloride can be made by dissolving 22 grams of Calcium Chloride in 100 ml of water. Calcium Chloride is often available as "ice melter" for your sidewalks.

The 2 molar solution of Sulfuric Acid can be made by dissolving 11 milliliters of concentrated Sulfuric Acid in 90 milliliters of water. CAUTION: Sulfuric acid is very caustic in both its concentrated as well as its diluted forms. Take appropriate cautions.

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FERMENTATION (Tara Denison)
Heat a 10% sucrose solution up until it's warm to the touch. Pour some solution into a fermentation tube. Put about 2 grams of fresh yeast in the tube with the solution. Shake and invert the tube so the solution and the yeast gets mixed up and so the solution stays at the bottom of the tube when it's turned right side up. Stopper the tube with a cotton ball, and set the tube down to wait for a reaction. Bubbles of CO2 will be produced because of the fermentation that's going on with the sucrose and the yeast. During the process of fermentation the yeast consume the sugar and give off CO2 and ethyl alcohol (C2H5OH). Students will see, smell, and be grossed out (fun!) when the bubbles push the cotton ball out and begin to ooze out the top of the tube.

Materials: 10% sucrose solution (10 grams of table sugar in 90 grams of water), yeast, fermentation tube, heating device (hot plate, microwave, etc.), beaker, cotton ball.

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MAGIC POLYMER BALLOON (Michael David Kaiser)

In this demonstration an inflated balloon is pierced from the bottom by a large needle that has been previously coated with cooking oil. The non-polar oil acts as both a lubricant and a binding agent allowing the rubber to polymerize around the needle and thus seal the hole without popping the balloon. Be sure not to pierce the balloon from the side because it will pop. The materials for this demonstration are simply one balloon, one twelve inch needle, and cooking oil. If you can't find a 12 inch needle try a Shish-Ka-Bob bamboo skewer. You do not even have to apply the oil since bamboo contains its own natural oils.

Polymers are an important area in chemistry. This demonstration gives students a good idea of some important properties of polymers. Other common polymers include PVC tubing, Kevlar, other plastics and even bubble gum!

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NON-BURNING DOLLAR BILL (Michael David Kaiser)

This is an old chestnut that is often used in magic shows as well as chemistry demonstrations. It can be easily demonstrated that alcohol burns in air by putting a few mL in an evaporating dish and lighting it. All students know that water puts out fires. A solution of half water and half alcohol however has some interesting properties. If a dollar bill is soaked in a 50/50 solution and then ignited by a match, the dollar bill will catch fire but not burn. This is because a 50/50 mixture still has enough alcohol to burn but there is enough water in the solution to wet the bill and keep it from burning. If you only have 70% denatured rubbing alcohol available, try mixing 100 mL of the alcohol with 50 mL of water. This should be close to the correct proportions.

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EXPLODING COLORS (Nicholas F Barnes)

This demo deals with surface tension. This works by adding 2% milk to a round aluminum pan, adding different colors of food coloring (red, yellow, green, blue) at points equally spaced around the pan. Then add the "magic solution" (clear dish detergent). And enjoy the magic colors!

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WATER TO GRAPE JUICE TO WATER (Courtney W. Willis)
Students are amazed to see both colored and clear liquids poured from the same container. Before the presentation you will need to prepare a pitcher full of water into which about 7 or 8 ml (one pop bottle cap) of household ammonia is added. You will also need 3 clear glasses. The first glass remains empty, while about 3 ml of phenolphthalein indicator solution is added to the second and 7 or 8 ml of household vinegar (5% acid) is added to the third. The phenolphthalein indicator solution can easily be made by adding 5 or 6 crushed EXLAX tablets to a 16oz bottle of rubbing alcohol.

To begin the demo pour the clear liquid from the pitcher into the first glass and the liquid remains clear. When the clear liquid from the pitcher is poured into the second glass a bright pink liquid is produced. The liquids are all poured back into the pitcher and the pink liquid is again poured into the first two cups but is turned clear when it is poured into the third cup. The most fun though is making up a story to go along with the demonstration.

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THE COLORS OF MOM (Courtney W. Willis)
Phillip's Milk of Magnesia (MOM) can be used to show a very colorful demonstration. Add about 10 ml of MOM to about 500 ml of water and a couple ml of universal indicator. Stir well.

This will produce a cloudy purple liquid. While continuously stirring, add a few milliliters of 1 molar hydrochloric acid until the solution turns red. As you continue to stir the color gradually goes through the colors of the rainbow and back to the purple color.

The MOM ($Mg(OH)_2$) is not very soluable in water therefore not all of it dissolves leaving the cloudy texture. The little that does dissolve makes the liquid slightly basic and accounts for the indicator turning purple. When the acid is added, the dissolved MOM is neutralized and the excess acid turns the indicator red. As some of the undissolved MOM begins to dissolve into the water, the pH gradually increases which accounts for the rainbow of color changes by the indicator. Eventually the solution is saturated with MOM and the pH is back to where it started. This demo can be repeated several times. When all the MOM has been dissolved and neutralized the liquid in the beaker will be a clear red.

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FLOATING EGGS (Trey Griffin)

This demonstration will amaze students with an egg floating between in the center of a clear liquids. Mix a solution of epsom salt and water to a point of super saturation. It will still look like clear water. Carefully add warm water on top of the solution. Once the mixture is created, it will appear to be homogeneous. Slip the egg into the solution and it will appear to be suspended in the container. It will remain above the epsom salt and below the warm water so that it floats in the middle.

MATERIALS: 1 300 ml jar, epsom salt, 1 egg

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Miwa, Ryan

Senior – Chemistry

Salt "Glue"

Materials: A small block of ice
Beaker of Water
Salt (NaCl)
Piece of cotton/wool thread or string

Method: Moisten one end of the thread. Place the moistened end of the across the block of ice floating on some water. Sprinkle the ice with salt and wait for a moment and then pull the tread up. The thread will be attached to the ice, which can be lifted from the beaker.

Explanation: The salt causes a phenomenon called freezing point depression. The salt causes the freezing point of the ice to be depressed because another compound is added, thus meaning that the ice has a lower freezing point than pure ice. The freezing point depression is a colligative property, which means that it is dependent on the presence of dissolved particles within a solution.