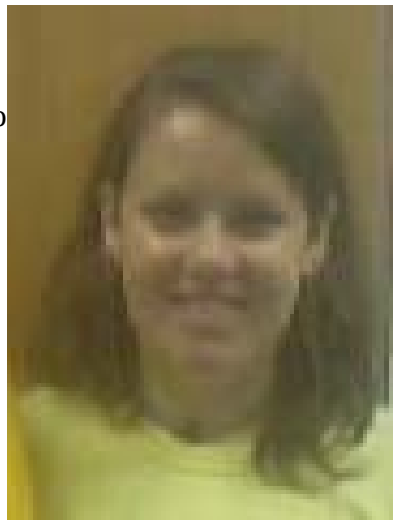
2008 Colorado Science Convention
"30 Demos in 50 Minutes"
Univ. of Northern Colorado Secondary Science Methods Class

Jackie Paris – Senior Biology Major



Adaptations:

Opposable thumbs are one of the physical adaptations that humans have that most other animals do not have. Other animals move about in their environment smoothly without this adaptation, but how would humans do without thumbs? To simulate this in the classroom a roll of masking tape will be used to tape students hand so that they no longer have use of their thumbs. Have them make the number 4, so that they are placing their thumbs across the palm of their hands, making the tape wrap around the palm, about the level of the first knuckle, making sure to include the thumb. Enough pieces of a small candy in a wrapper, such as Starburst, Tootsie Rolls, Kisses for each student to have and small combs will be needed for each student. Once the students are tapped up, have them open the candy and comb their hair with only their 4 fingers. After a little bit of trying, tell them that they can use other tools, like their mouth and other body parts, but let them explore the other options without much direction. If they are feeling ambitious, have them untie and re-tie their shoes, again with no thumbs. After the activity talk with them about how they had to make modifications to do these everyday things that are typically very easy, because of thumbs. Ask if them if they think they would get better over time by practicing these activities with no thumbs?

Metabolism:

There is a good chance that there is a student in your class who is lactose intolerant or that they know someone who is. But do they really know what that means, and do they understand how this intolerance works? While going over metabolism, students commonly have a hard time picturing molecules breaking down because they have not seen this process or can relate it to something in their life. Here is the chance to prove that it really happens. To demonstrate this you will need a glass of room temperature milk in two test tube sized containers, two glucose test strips as well as Lactaid (or an equivalent product). With both containers of milk in front of you, place a glucose test strip into one of the test tubes to show that there is no glucose in the milk originally. Then, place Lactaid in the milk in the other test tube, letting it dissolve fully. Then, test this milk that has the Lactaid with the glucose test strip. The test strip will show a positive reading because there is no longer lactose in the milk, but rather its components due to metabolism. The Lactaid breaks down the lactose into galactose and glucose. People who are lactose intolerant do not have enough of the enzyme lactase, the primary component of Lactaid, in their small intestine to sufficiently break down this complex sugar on their own. The addition of Lactaid allows the lactose to be broken down so these more simply digested sugars are produced; therefore, individuals who are lactose intolerant can still consume food that contains lactose by taking products that are able to simulate what the digestive system is designed to do.

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

$CO_2 + H_2O \rightarrow H_2CO_3$

$H_2CO_3 + H_2O \rightarrow H_3O^+ + HCO_3^-$

This causes the solution to become more acidic, changing the color of the universal indicator.

Potato Battery

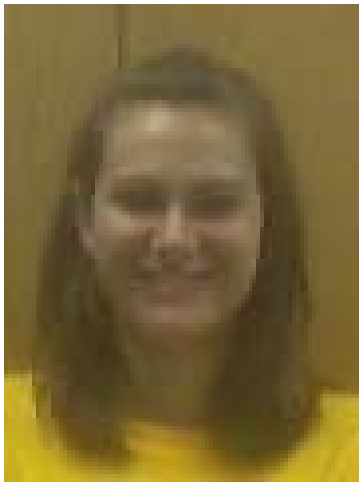
Materials:

- 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.

Kristen Hutchcraft – Junior Biology Major



Nerve Demo

Introduction:

This demonstration shows just how sharp different sensations are and how our nerves react to those sensations. The brain uses a process called habituation to keep itself from overloading. Sharp sensations get the brains attention but everyday sensations do not get the brains attention.

Materials:

- Deck of Cards
- Pair of Socks

Procedure:

- Wear shorts or roll up your pants
- Take off shoes and socks

- Spend a few minutes building a card house
- Put back on the socks with your eyes closed, and try to locate the tips of your socks by pointing at them
- Keep your socks on and build the house again for awhile
- Now try to point to the tips of your socks

Discussion:

The first time that you put on the socks on it is a new sensation for your brain so it noticed the difference. The second time that you pointed to the socks your nerves were used to the sensation of the socks on. Thus, it was harder to locate the tips of the socks.

Safety:

- Don't fall off the chair trying to find your toes!

Food Webs and Chains

Introduction:

Food chains and webs are a part of every ecosystem. In this demonstration it shows how food webs and chains get tangled together and how they depend on each other. This will also show how the organisms depend on each other.

Materials:

- Scissors
- 50 1m lengths of string
- 50 arrow cut outs
- Animal and plant cut outs with holes punched

Procedure:

- Give the students a ziplock bag of the plants and animals, a string and arrows
- Take an organism out of the bag and create a food chain by linking the organisms together.
- Once the food chain is made let them put the arrows to follow the flow of the chain.
- Join the different chains together to make a web by putting the same organisms together and make new links
- Hold the web tight by each student
- Cut off a top predator to show the students what happen to the links. The rest of the food web will stay intact
- Then cut a primary producers are removed. Cut the links as the primary consumers die off all the others will die off.

Safety:

- Do not run with the scissors
- Recycle this experiment so you can use it for years to come

Cell Membranes from Eggs

Introduction:

In this demonstration a cell membrane will be formed by using an egg yoke. The membrane will capture either water, oil, or both. This way it will be easier to see the different cells.

Materials:

- Water
- Oil
- Egg
- Flask
- Eye dropper
- Small dish

Procedure:

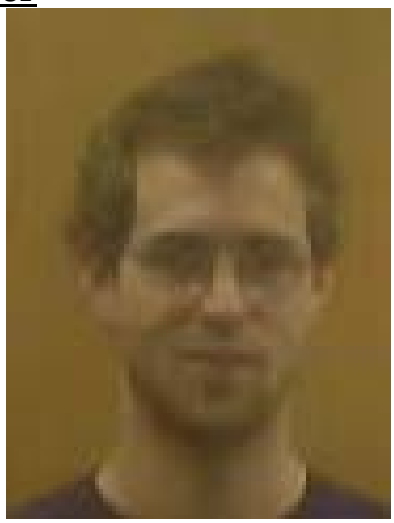
- Add 100 mL of water to the flask
- Add 25 mL of oil to the flask

- Shake and then let separate
- Crack open the egg and put in a small dish
- Take the eye dropper and suck out some of the yoke squirt drops into the oil and water mixture.
- Wait for the reaction of the egg surrounding the water and oil to form cells

Discussion:

In this demonstration it will show how cell membranes can be formed. This demonstration should help students realize how cell membranes can split and multiply.

Dillon Glatther – Senior Earth Sciences Major



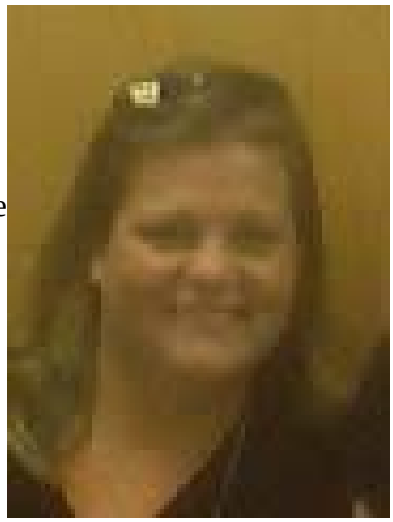
Rate of Evaporation

This demo shows that evaporation removes heat only using three thermometers. One thermometer is the control. One is wrapped in a water soaked paper towel. And the last is wrapped in an alcohol soaked paper towel. Since alcohol evaporates the fastest the thermometer should show the fastest temperature drop. The water one will show less of a drop and the control should change very little.

El Nino

This demo uses a clear tub with warm, red water over clear cold water to depict normal Pacific ocean layers and compare to El Nino.

Sara Robida – Senior Biology Major



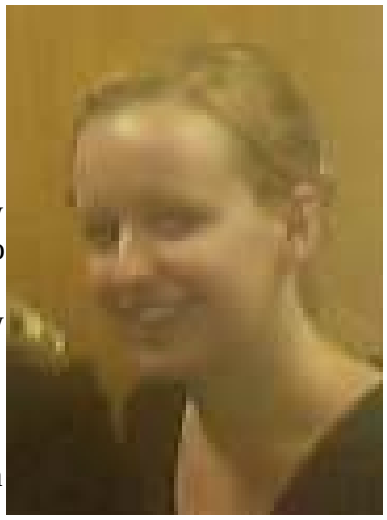
Newton's First Law

In this demonstration, the teacher puts an empty glass bottle on the tabletop, balances a large embroidery hoop on top of this, and balances some object smaller than the bottle (i.e. coin, marker) opening at the top of the hoop. When the hoop is quickly slipped out from between the bottle and the marker, the marker will drop straight down into the bottle. When the hoop is yanked out of the system, it needs to be grabbed from the inside of the hoop. If the hoop is grabbed from the side, the force will distort the circle of the hoop and the marker will be thrust upward, and it will not fall in the bottle. This demonstration illustrates Newton's first law (inertia). So, to begin the whole system is at rest. When we remove the hoop, gravity works on the marker, thus it falls straight down into the bottle.

ATP Energy Release

For this demonstration the teacher needs four blocks of wood sized so that they can be bound together with a regular rubber band. Three of the blocks should be labeled as "P"s, and the fourth should be labeled as an "A". The A block and two P blocks should be bound together with glue, tape or rubber band in the following order: APP. The fourth block should be rubber banded to this complex next to the P. This assembly represents a molecule of ATP. When we discuss ATP as the energy source for cells, the students can have a hard time envisioning how the cleavage of a phosphate group releases energy. In this demonstration, we discuss ATP and then snip the outer rubber band, releasing one of the P blocks. The rubber band will fly off the assembly, its kinetic energy analogous to the energy released from ATP. This gives the students a visual reference of this process.ATP

Kayleigh Wellington – Senior Biology Major



Curved Space

For the first demo i want to use jell-o to deomstrate how space bends around planets and stars. For this demonstration i will need a bowl of jell-o and a variety of fruits, candies and nuts. The fruits, candies and nuts represent the planets and stars and other such objects in the univerese. The jell-o represents outer space. When the "stars" and "planets" are placed on top of the jell-o you can observe how space bends around different types of matter. By rolling the objects across the jello you can determine which objects have the most mass. Objects with lots of matter won't always contain the most mass and you can observe this when looking at how the jello bends for different objects.

Length of the GI Tract

my second demo is demonstrating the length of the GI tract. I will do this with a piece of rope that is 8.5 meters in length. Each section of the GI tract will be color coded to show how long each part is. I think that this will be more effective if i can get an anatomy model, either one that can be that shows theabdominal/thoracic area or even a skeleton. This was i can place the rope inside of the model and pull out each section one by one. Would you be able to get a model from the biology department?

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:

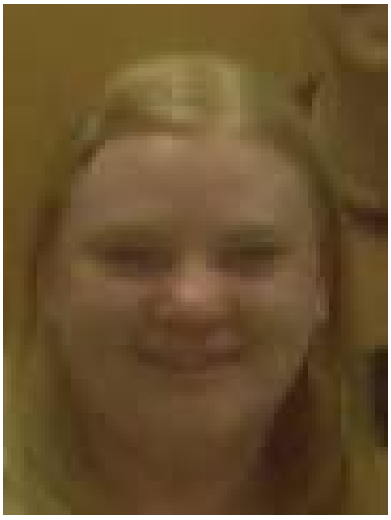
Hydrochloric, sulfuric and nitric acid, 6M or stronger
Sodium hydroxide, 6M or stronger
Raw eggs or egg whites
Petri dish
Beral pipets
Overhead projector
Permanent marker

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.

Laura Marschke – Graduate Earth Sciences Major (undergrad. Physics Major)

Candy Cratering



Purpose:

The purpose of this demonstration is to show, in a simplistic way, the nature of impact crater formation. This demonstration can be easily expanded to a laboratory exercise for students to learn more about impact crater formation and the relationships between mass, velocity and crater size.

- As a lab activity, the "meteorites" will be moving too slowly to create all the observed features of impact craters. This can be discussed before or after doing the lab.

Materials:

this is the material list for a lab activity; not as much is needed for a demonstration; multiply the supplies by the number of groups if doing a lab

- Deep plastic container (shoe box size)
- 6-8 cups of flour
- Chocolate drink powder
- Sifter or small strainer
- Powdered sugar
- Candies of multiple shapes and sizes to be used as "meteorites"
    - Recommended: peanut M&Ms, jelly beans, whoppers, milk duds
    - Corn, beans, marbles, and beads would work as well
- Meter stick
- Garbage bags
- Scissors
- Smooth object to smooth out layers
- Spoon/tongs/large tweezers (to retrieve meteorites)
- Stop watches (optional)
- Goggles are recommended if you are doing this as a lab activity

Procedure:

- Cut open a plastic trash bag and lay out on the counter or tape to the floor
- Place the plastic container on top of the bag and fill approximately 2/3 full of flour
- Tap the container gently on the table or floor to settle the flour and smooth if necessary
- Using the sifter, place a coating of powdered sugar on top of the flour (this helps to provide a barrier so the candy isn't flour-coated when the activity is done)
- Use the sifter and sprinkle a thin layer (approximately 2 mm thick) of chocolate drink mix over the flour to act as top soil
- Stand up the meter stick and drop candies of various sizes from various heights
    - Use of meter stick is not really necessary for a demonstration since you can easily show higher and lower drop heights
- Watch craters form!
- Repeat as necessary/desired and watch craters form on top of craters (older craters versus younger craters)

- Retrieve meteorites, smooth and re-powder the top layer when a clean start is needed (i.e., when you can't see which craters you are currently making)

Additional measurements and information that can be discussed in a lab setting:

- Diameter of crater
- Depth of crater
- Velocity of projectile (would need stop watches)
- Diameter of ejecta
- Mass of projectile
- Width of crater at largest point
- Sketches of crater and crater patterns made by different "meteorites"
- Which craters are "older" and "younger" and why
    - Crater counting activities can be used in conjunction with this information

Note:

This demonstration was adapted from the activity Dr. Shauna Sallmen (University of Wisconsin – La Crosse) and I taught at a "Girls in Science"conference. However, the following are terrific websites to help expand the demonstration into a lab:
http://www.rpls.ws/lgiat/2007/READ/Lunar_Crater_Lab.pdf (candy lab plus cratering notes)
http://www.spacegrant.hawaii.edu/class_acts/CratersTe.html (same lab concept with different materials, blank data table pages, blank graph paper, and teacher note pages all linked to this page)

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

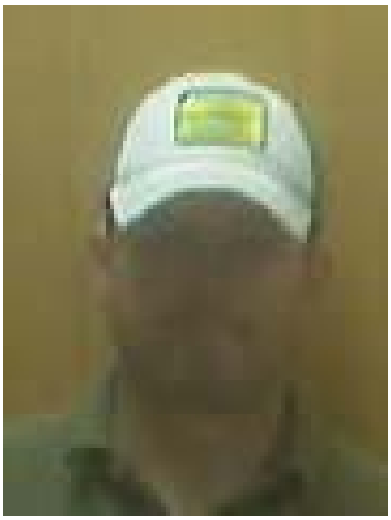
Safety Precautions:

- 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

James Neily – Senior Biology Major



Diffusion Demo

Cells use certain substances to carry on the activities that keep them alive. These substances enter through the cell membrane by a process called diffusion. Substances move from where they are more concentrated to where they are less concentrated. The cell membrane is semi permeable, which mean some things can pass freely back and forth due to their small size.

This lab demonstrates the idea of diffusion through a semi permeable membrane. The plastic bag is reprenting the membrane and the two substances are starch(a complex carbohydrate) and iodine(simple element).

The iodine moves freely through the plastic bag from an area of high concentration to an area of low concentration down the concentration gradiant. The changes in color represent the iodine diffusing into the starch. The starch is too large of a molecule to pass through the plastic bag and remains on the side of high concentration. The test tube is the control, the impermeable membrane that does not allow anything to pass through it.

Materials

3- Baby food jars or 250ml beaker
1- test tube
2- plastic bags
15ml of iodine
15ml of Starch solution
5ml pipet
2- Twist Tie

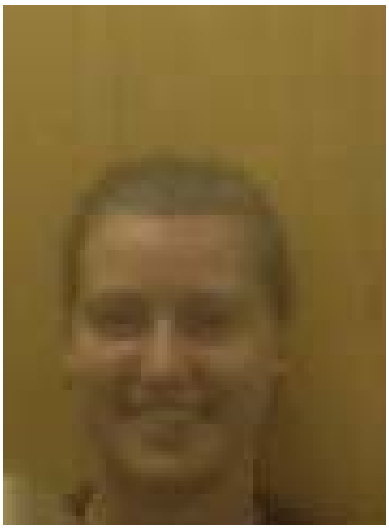
Procedure

Label the three jars A, B, C
Put 5ml of iodine into jar A
Put 5ml of Starch solution into jar B
Put 5ml of iodine into jar C
Put 5ml of iodine into one of the plastic bags and close the bags with the twist tie, make observations
Place the bag of iodine into jar B
Put 5ml of Starch solution into the second plastic bag and close it with the twist tie, make observations
Put the bag of starch solution into jar A
Put 5ml of Starch solution into the test tube and make observations
Place the test tube into jar C
Let stand overnight (Some reactions occur with in 2-3 hours)

Vanilla Balloon (Diffusion Demo)

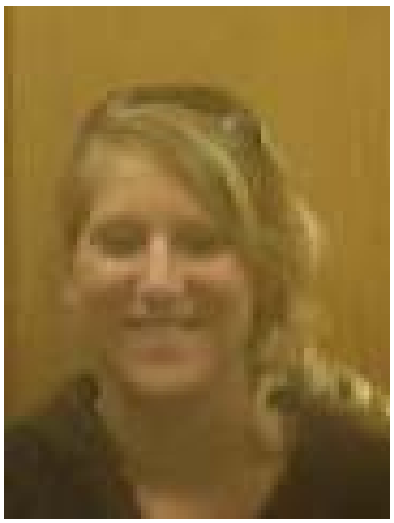
Take a medium sized balloon and place 3ml or so of vanilla extract (Almond also works) intto he balloon and rub it around the interior of the balloon to coat as much of the inner surface as possible. Take a couple deep breaths and blow the balloon up. Tie it off. Allow the extract to begin to diffuse while you exaplain the principle of diffusion. Explain how the extract will move across the membrane of the balloon going from a high consentration to a low concentration of vanillin (the vanilla smelling particles of the extract) across the concentration gradiant. When you have finished your explaination of diffusion pass the balloon around and see if anyone can smell vanilla demonstrating that the vanillin has moved outside the inner membrane of the balloon that it once coated in a high concentration.

Cathrin Fronthaler – Austrian Exchange Student



Cathrin is a Geography Major from Salzburg, Austria. Although she is not a science major she has been attending the UNC Secondary Science Methods class this semester and has given us much insight into the differences between the Austrian and other European educational systems and the US educational system. Cathrin will be helping us with some demos and will be our official "Vanna White" or our official "European Demonstration Model"

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.

Balloon - **Pressure Demo**

Introduction:

This demonstration helps students to understand pressure. Using a water balloon resting on top of a glass jar, students will understand the forces that makes the balloon move into a glass jar.

Materials:

Glass Jar with a medium sized mouth
Water balloon
Small piece of paper
Lighter

Procedure:

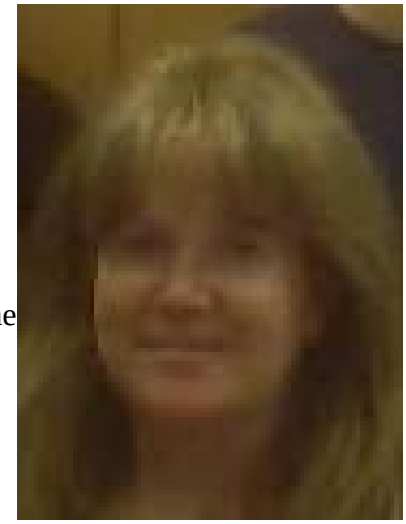
- Light a small piece of paper on fire

- Drop the piece of paper in the glass jar
- Quickly place the water balloon on the mouth of the glass jar
- Stand back and watch as the water balloon gets sucked into the glass jar

Discussion:
This demonstration shows pressure. It demonstrates that the pressure outside of the jar is so great, that it pushes the water balloon into the jar.

Eileen Duncan – Graduate Eath Science Major

Cloud in a bottle.



Purpose: to show students how to create their own cloud.
Materials:
2 liter plastic bottle, clear (soda type)
Hot/warm water
Matches
Procedure
Fill the bottle about ¼ full with warm water. Light a match, hold the bottle sideways as much as possible without spilling water. Place burning match into the bottle. Cap immediately to capture smoke. Shake bottle to remove condensation from the sides. Squeeze the bottle, then release quickly. A cloud will form, you can then squeeze the bottle again and the cloud will disappear.
Why?
Water provides the water vapor in the air, smoke particles serve as a cloud condensation nuclei (something for the water vapor to condense on to), squeezing the bottle compresses the air within the bottle increasing the temperature (just as high pressure in the atmosphere) causing evaporation (or water to remain in its vapor state), releasing the bottle decompresses the air in the bottle decreasing the temperature allowing condensation to occur (just as it does with low pressure center in the atmosphere) water vapor condenses into liquid form.

Golden Red Sunrises and Sunsets

Purpose: To show students why the sky is blue and sunrises and sunsets are orangey/yellow.
Materials:
Large glass jar
Overhead Projector
Flashlight
Creamer
Procedure:
Fill large glass jar halfway with warm water, set on top of an overhead projector. Show how the water is clear and the light reflected on the screen is white (clear – all the wavelengths of light are passing through the water).

Add a small pinch of creamer and stir. Point out that the water in the jar is turning a grey/blue and the light on the screen is beginning to turn yellow/orange.

Add a second small pinch of creamer stir. Point out that the water in the jar is even more bluish/grey and the light on the screen is more orangey/yellow.

Last, turn off the lights, shine a flashlight at your audience and point out that the light is white.

Next, shine the flashlight through the jar with the beam of light towards your audience. Point out how it is now yellow (the water is bluish/grey still).
Why?

Blue wavelengths are smaller than yellow/orange/red. The water represents the air, the creamer represents the pollution in the atmosphere, and the overhead light and the flashlight represent the sun. The sun

emits all wavelengths of the visible spectrum. That light is white. However, when it passes through our atmosphere the pollutants scatter the blue wavelengths since they are small and allow the loner wavelengths, yellow, orange, red to pass through. So when we look through the atmosphere at the sun (at sunrise or sunset) the sun appears orange and the sky is a faint blue.