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:

less than the pressure outside of the glass. Therefore water will be pushed into the glass. This should be repeated with more than one candle lit. To do this, rubber band several candles together and repeat the experiment. Because there are more candles, the air will get warmer forcing more to escape the glass. This will cause a greater pressure difference and more water will be pushed into the glass. This also shows that the result is due to the heating of the air rather than the candle "burning-up" the oxygen in the glass. If it was due to the "burning-up" of the oxygen then the water level should be the same no matter the number of candles.

Demonstrations by Anthony Scott

Graduate – Biology

"Acid Breath"

Materials:

- Test tube
- Bromthymol Blue
- Balloon

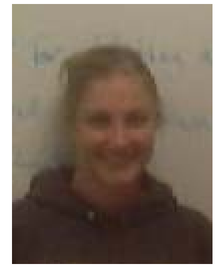
Procedure:

how many organisms are in the population of a given area all will be affected by the earthquake and density does not increase the effect of the earthquake on the population.

When to use:

This is a great way to show the difference between density-dependent and density independent factors that effect populations in an ecology unit.

Demonstrations by Amanda Bauldridge



Senior – Biology

"Invisible Test Tube"

It's a test tube leaning in a beaker of corn oil. The tube is actually "invisible" in the oil! Put any amount of **corn oil** in a beaker. Place three clean Pyrex test tubes into the beaker. Fill one will corn oil, one with water, one with whatever substance (I used yellow die in water so it would look the same as the corn oil). You should see the following: The two without the corn oil will look bent, and the one with the corn oil will be invisible. How come? The index of refraction of the Pyrex tube is virtually the same as that of corn oil and they make the light bend by the same amount so there is no "boundary"" between the tube and oil!

Original Source: http://www.darylscience.com/Demos/InvisibleTT.html

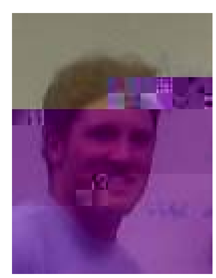
"The Fireproof Balloon"

Balloons are rather fragile things. They need to be kept away from sharp objects and flames. However in this experiment you can hold a flame directly under a balloon without it breaking. Inflate a balloon and tie it shut. In a second balloon fill it (not inflated) with water, and then blow it up about the same size as the first balloon and tie it shut. Hold a match directly under the first balloon. What happens? The balloon breaks. Light another hold it under the second balloon. What happens? It doesn't break.

Why does the balloon with water in it resist breaking in the flame? When water inside the balloon is placed in the flame, the water absorbs most of the heat from the flame. Therefore, neither the air in the balloon, nor the rubber gets hot enough to weaken and break the balloon. Water is good heat absorber. It takes a lot of heat to change the temperature of water.

Original Source: http://scifun.chem.wisc.edu/homeexpts/FIREBALLOON.html

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.

"Marker on a hoop"

Scientific principle:

This demo illustrates the force of gravity as well as Newton's first second law of motion. The marker is the object at rest that tends to stay at rest. When the hoop is removed, the marker "falls" as the force of gravity takes over. The hoop is the object in motion that tends to stay in motion (forward moving). When this demo does not work, 1) the hoop is pulled too slowly or in a crooked fashion so as to "pull" the marker into a forward motion or 2) the marker or coin is too large or not aligned with the bottle hole.

Materials:

- Embroidery hoop
- Bottle
- A marker or coin that has a smaller diameter than the opening of the bottle

Procedure:

Place the embroidery hoop on the opening of the bottle. Stand the marker or lay the coin on the top of the hoop. (Hint: Align the object so it is placed directly over the opening of the bottle.) Pull (snap!) the hoop away and the marker will drop in the bottle.

Demonstrations by Lindsay Eklund

Senior – Biology

"The Collapsing Can "

Materials

1. One empty aluminum can (354 ml)
2. A Hot plate or burner
3. Large bowl of water
4. Tongs to hold pop can

Procedure

1. Put about 5 ml of water in the pop can (just enough to cover the bottom).
2. Heat the can over the hot plate or burner.
3. Let the water boil vigorously.
4. In a single motion, remove the pop can from the burner and INVERT it in the bowl of water.
5. Submerge the opening to the pop can in to the water. The can will IMPLODE instantly.

Questions

1. What was in the can besides water?
2. What happens when water is boiled?
3. What do you think will happen if the can is inverted in the bowl of water?
4. What happens to the air in the can as water vapor is formed?
5. What force is working on the outside of the can?

Rationale

Before heating, the can was filled with water and air. By boiling the water, it changes states, from liquid to gas (water vapor). The water vapor (steam) pushes the air that was inside, out of the can. By inverting the can in water, we are cooling the vapor very quickly and constraining the potential for rapid flow of air back into the can. The cooling condenses the water vapor back to water. All of the vapor, which originally took up the interior space of the can, is now turned into a few drops of water, which take up much less space. This causes the pressure to drop and the atmospheric pressure is therefore pushing on the can and crushing it.

The total force working on the outside of the can is the total of the can's surface area in square inches multiplied by atmospheric pressure (about 14.7 pounds/in^2).

Demonstrations by Adam McBride

Senior – Chemistry

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

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.

Demonstrations by Elizabeth Meece

Theory: Exothermic reactions yield energy. This energy usually appears in the form of heat, with some reactions producing heat and light. Chemiluminescent reactions produce mostly light energy with little to no heat. Chemiluminescent reactions are responsible for the flashes of light that fireflies produce.

Materials:

1L Graduated Cylinder
2 500mL Erlenmeyer Flasks
1L Distilled Water
2.0g Sodium carbonate, Na_2CO_3
12.0g Sodium bicarbonate, $NaHCO_3$
0.1g Luminol, 3-aminophthalhydrazide
0.2g Cupric sulfate pentahydrate, $CuSO_4 \cdot 5H_2O$
0.25g Ammonium carbonate monohydrate, $(NH_4)_2CO_3 \cdot H_2O$
25mL 3% Hydrogen peroxide, H_2O_2

Safety: 3% hydrogen peroxide is very weak, but still an oxidizer and a skin and eye irritant. Always wear goggles when performing chemical work.

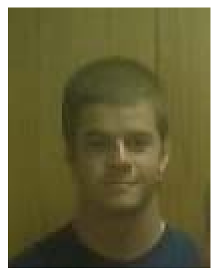
Procedure:

1. Prepare the following solutions:
   a. In a 500mL flask, dissolve 2.0g sodium carbonate in approximately 300ml distilled water. Add 0.1g luminol, stir to dissolve. Add 12.0g of sodium bicarbonate, 0.25g of ammonium carbonate and 0.2g and 0.2g of cupric sulfate, stir to form a solution. Dilute to 500mL.
   b. In a 500mL flask, add 25mL of 3% hydrogen peroxide, dilute to 500mL and mix well. Prepare this solution within one hour of performing the demo.
2. Dim the room lights and pour the contents of both flasks simultaneously into the 1L graduated cylinder. The solutions will react and produce a blue glow that persists for about 30 sec.
3. The solution can be disposed of with excess water, down the sink.

Adapted from Flinn Scientific Demo-a-day for high school chemistry.

<u>Demonstrations by Andrew Huntsman</u>

Junior – Physics



"Egg in Bottle"

Materials:

1 hardboiled egg
1 glass bottle with opening slightly smaller than a hardboiled egg
Paper and matches to light the paper

Procedure

Remove the shell of the hardboiled egg
Light some paper and place in the bottle
Place the egg on the opening of the bottle
Watch the egg get pushed into the bottle

Explanation

The Fire in the bottle heats the air temperature. Placing the egg on the bottle cuts of any oxygen source to the Fire and smothers it. When the fire is out the air in the bottle cools and creates a lower pressure in the bottle than outside the bottle. The higher pressure out side the bottle pushes the egg in the bottle.

Demonstrations by Cynthia Arnett

Additional Baccalaureate – Biology

"Balloon Rocket"

Balloons can be use to demonstrate Newton's third law:
for every action there is an equal and opposite reaction.

Supplies needed:

Balloons (straight balloons work better than other shapes)
Drinking straw
String
Tape

Procedure

Blow up a balloon and hold it without letting air out.

Ask the students what will happen if you let go of the balloon neck while holding the neck.

Most students will answer that the air will come out. Ask them why?

The atmospheric pressure outside the balloon is applying force to the sides of the balloon. The force exerted on the balloon is squeezing the air out. The force of you holding the balloon is preventing it from moving.

Blow up the balloon again. Ask what will happen if you let go of the balloon. They will answer the balloon will fly away. Why? Have two students hold a string taunt across the room. Thread the straw onto the string. Tape the blown up balloon to the straw. Let go. The balloon will travel from one end of the string to the other.

Probe the students with questions about what happened and why.

Why did the balloon move?
Why did the balloon move in the direction it did?
What were the forces involved?
Which of Newton's law apply?

The air pushes against the sides of the balloon, the sides push back. The air is forced out of the balloon the balloon is forced in the opposite direction. Newton's Third law. This is how rockets work.

Variation.

Place the straw with the attached balloon in a bottle to make a bottle rocket.

For more information and variations visit:
http://www.brown.edu/Departments/Swearer_Center/Projects/PSO/Lessons/balloonrockets.htm
http://www.iit.edu/~smile/ph9608.html
http://www.at-bristol.org.uk/Newton/experiment.htm

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:

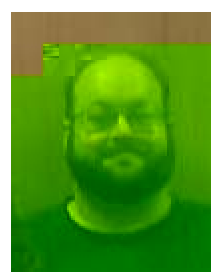
$Na_2O_2 + H_2O \longrightarrow 2NaOH + O + Heat$

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 Brooks Williamson

Graduate - Chemistry



Demonstrations by Kimberly Mason

Sophomore – Elementary Education (Physics)