University of Northern Colorado

SCED 441 – Methods in Teaching Secondary School Science

Demonstrations
Presented at
the
Longs Peak Science and Engineering Fair

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These demonstrations are not licensed in any way.
Please use appropriate safety precautions!

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Science Demonstrations –Zach Daubert

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.

Pressure Bottle

Materials

Large plastic soda bottle
Thumb tacks
Water
Large bowl
Food coloring

Set-up

Fill the bottle with water and food coloring. Cap the top.
Push the thumb tacks into the bottle vertically down the side of the bottle.

Procedure

Hold the bottle up and pull the tacks out of the bottle.
Unscrew the top and hold the streams of water over the bowl

The Science

Each hole created by the thumb tack has a different water pressure pushing the water out of the hole which is governed by the depth of the water (distance the hole is away from the cap). The difference in water pressure causes the streams to be different lengths and as the water level drops the streams get shorter.

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.

Science Demonstrations –Amber Fryar

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.

<u>Science Demonstrations –Josh Martinez</u>

Acetone and Styrofoam

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)

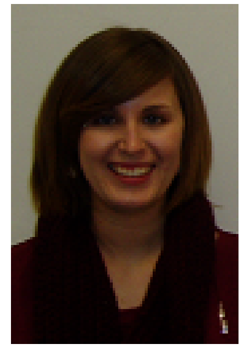
Procedure:

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.

Science Demonstrations - Alexis Tanner



DNA Extraction

Concepts:

How DNA looks

Materials:

Strawberry
meat tenderizer
detergent
isopropyl alcohol
water, salt, beaker, test tube, cheese cloth, paper clip, Ziploc bag

Procedure

In a plastic bag, add a strawberry and 5mL of water. Add 1g salt, 2g meat tenderizer, and 1mL detergent. Macerate mixture. Once the crushed strawberry solution is ready, strain it through a cheese cloth into a beaker. Transfer this material to a large test tube. Carefully pour the cold isopropyl alcohol down inside the test tube until you have about an inch layer on top (2 separate layers should be visible). Using a paper clip, swirl the alcohol layer so DNA can precipitate from the pink layer into the alcohol layer.

What is happening?

Using the different reagents from above, the DNA is being extracted from the strawberry. First, the meat tenderizer release papain, a protease enzyme that breaks down histone proteins then frees the DNA. The salt helps isolate and precipitate the DNA by shielding the phosphate groups on the backbone of the DNA. The detergent helps break down the cell membrane. The ethanol precipitates the DNA.

Osmosis

Concepts

How does osmosis work?

Materials

2 pieces of lettuce (or 2 pieces of celery)
1 bowl of DI water
1 bowl of salt water

Procedure

At the beginning of the demonstration, ask students if they think leaving the lettuce (or celery) pieces in plain water or salt water will help keep the lettuce more crisp. Set a piece of lettuce in each bowl and wait (possibly till the end of the period.) Go back to the bowls and bend the lettuce from each in your hands. The lettuce from the water bowl will still be crisp; however, the lettuce from the salt bowl will be limp in your hands!

What is happening?

In this experiment, osmosis is taking place through the lettuce. In the bowl with just water, the concentration of water is equal on both sides and therefore no movement is happening. In the bowl with salt, however, the concentration of water is higher inside the lettuce than within the salt water. Therefore, the water moves out of the lettuce, causing it to become limp.

Science Demonstrations - Jeff Hoffman

Torque and Door Demo

For this demo, the only material that is needed is a door. Different ways of pushing on the door can demonstrate the concept of torque. Have students use their index finger to push the door from the end, middle, and by the hinge with equal force and note what differences they see. Have students try various other ways of pushing such as at an angle that is not perpendicular to the door. Using these observations, let students know that with this concept, if someone had a long enough lever, they could lift any object.

Coriolis Effect Demo

For this demo, a pen/pencil, paper, and either any sort of rotating object or another person are needed. Place the paper on the rotating device, or have the second person hold the paper and in whichever situation, rotate the paper counter-clockwise. While the paper is rotating, have the person with the pen/pencil start at the center of the paper and try to draw a straight line in any direction. Afterwards, observe what the drawn line looks like. Which way does it curve? Then try clockwise. What way does the line curve? Explain to the observer that in the northern hemisphere, moving air is subjected to this same occurrence and is curved right. In the southern hemisphere, air is curved to the left.

Water Pressure Demo

The materials required for this demo are a plastic bottle, tape, a puncturing device, and water. Start by puncturing various holes in the same vertical column from the top of the bottle to the bottom. Use the tape to tape over the holes. Afterward, fill the bottle with water. It is now ready to be used. When showing the demo, remove the tape quickly and have the observers look at how water squirts further away from the bottle if it was coming from a hole on the bottom.

Science Demonstrations - Hannah Mueller

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.

Newton's 1st Law Egg Drop

Materials:

1 egg
1 glass of water
1 cake pan (or Tupperware with a lip or edge)
1 empty toilet roll

Procedure:

1. Set up your materials in the following order, from the table top: glass of water, cake pan, empty toilet roll, egg.
2. As quickly as you can, hit the cake pan to the side.
3. The egg should drop directly into the glass of water.

Explanation:

The egg does not have any force directly action upon it. Since you hit the cake pan, the cake pan's movement affects the toilet roll, but the toilet roll doesn't directly affect the egg. This is because of Newton's 1st Law of Motion, which states that an object at rest will tend to stay at rest, until another force acts upon it. Since the egg is initially at rest, and the toilet roll does not exert any force on the egg, the egg will fall only due to its own weight (mass * gravity).

Tips:

- Practice this before you do your demonstration. You need to be quick with your hit. Don't wimp out! ☺
- Raw eggs work well, but for added safety, hard boiled works fine as well.

Safety: There may be a small "splash zone" when the egg falls into the glass of water and may be messy. Also, if not done correctly, the egg may break, and may also cause a mess. Be wary of students who may be allergic to eggs as well.

Skittles Taste Test

Materials:

1 Bag of Skittles

Procedure:

Give each student one Skittle (or more of the *same flavor*)
Tell everyone to pinch their nose.
Eat the Skittle.
Ask for observations
After a few seconds, release your nose.

Explanation:

Though at a glance the procedures seem easy, students (and you!) shouldn't be able to actually taste the flavor of the Skittle with your nose pinched. Observations may be about texture, but not much else. Once you release your nose, you should be able to taste the flavor of the Skittle. This is because your tongue can only taste or sense sweet, bitter, salty, sour, and umami. The receptors in your nose are much more complicated, and "fill in the blanks" of what you're tasting. This also explains why when someone is sick and their nose is congested, food can taste very different!

For more information, this article is very helpful, and is more detailed: http://www.brainfacts.org/sensing-thinking-behaving/senses-and-perception/articles/2012/taste-and-smell/

Tips:

- Make sure students have their noses *completely* sealed. This makes for the most drastic change.
- Lemon flavor tends to have the strongest reaction out of all the flavors.
- I have tried this with other foods such as chocolate, and it works pretty well with that too. Experiment with other foods as well!

Safety: Be wary of any food allergies students may have. You may have to change the food based on that.

Science Demonstrations - Mike Schmidtbauer

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.

Diffusion

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.