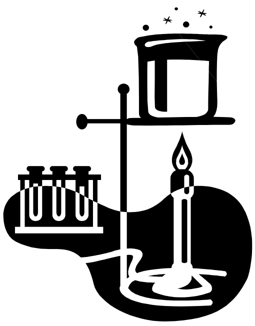

SCIENCE DEMONSTRATIONS, EXPERIMENTS etc for OPEN DAYS & PRIMARY SCHOOL VISITS

(These are just some of the experiments/demonstrations shared by many LABBIES – hope you find some of them useful - Debbie Darby)

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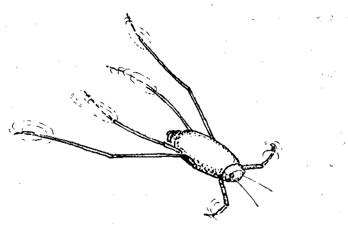
ACTIVITY ONE: Surface Tension

Why is it so?

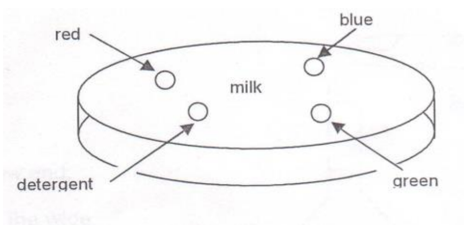
Why don't water striders sink when they are "walking" across water?

Water is made up of particles. The water partic attract each other. Water particles are not as attracted to air particles. Remember water for drops in air, eg: rain. The water particles cling together at the surface. This acts like a "skin" the water. We call this force **surface tension**.



The very light water strider does NOT break this surface tension and so we see them "walking" across the water!

Set up a petri dish of milk as shown in the diagram with 2 drops of each of 3 food colouring liquids. Quickly add 2 drops of detergent. Describe what happens.



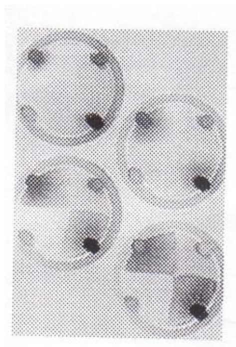
Why did this happen?

When only the food colours are in the dish, the colours stay in their place. Adding detergent reduces milk's surface tension. The milk can now mix with the food colours.

ACTIVITY TWO: Chromatography

1. Fill a petri dish up with water.
2. Place 4 different coloured jellybeans around the dish like the diagram at right.

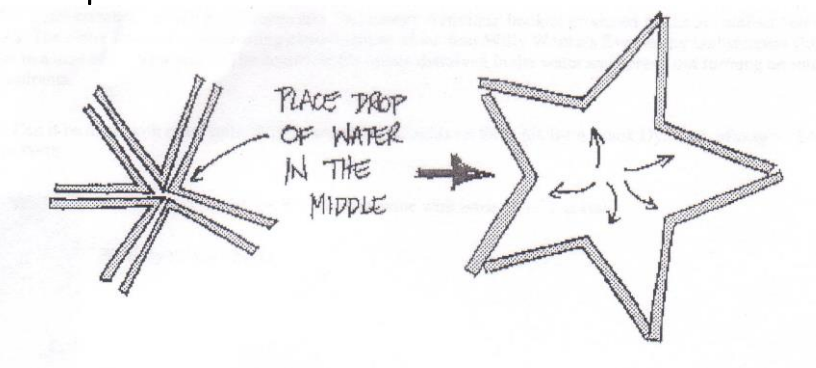
3. Describe what happens.



Why did this happen?

Jelly beans contain sugar and food colours. The sugar and food colours dissolve in water. This is like you making a cordial drink. The colours spread into the water. If there's too *much sugar, the different colours do not mix well.*

ACTIVITY THREE: Expansion



1. Break 5 toothpicks in the centre and bend them so you have 5 V-shapes.
2. Place the points of the 5 V-shapes together in a petri dish.
3. Put a large drop of water in the centre.
4. Watch as the toothpicks begin to expand and form a star shape.
5. Describe what happens.

Why did this happen?

When the toothpick is broken, some of its wood fibres are exposed. The water soaks into these fibres. This is like water soaking into a paper towel's fibres. The broken parts expand as the water gets in. The water also makes it slippery inside the dish. The toothpicks move outwards to allow for this expansion. If you did it correctly, the ends of the toothpicks match up to form the corners of the star.

ACTIVITY 4 - Bubbles

Bubble Formula #1 - For general blowing and popping fun
2.5 litres of distilled water
1 cup of detergent (best quality you can)
1 Tablespoon Glycerine

Bubble Formula #2 - For bigger bubbles
Same as #1 only add 1 – 2 cups of quality commercial brand solution
(Wonder Bubbles, Mr. Bubbles - a soap solution brand not the bubble bath)

Bubble Formula #3 **- For longer lasting small sculptures; probably too 'heavy' for big bubbles**
Same as #2 only
add ¼ cup of detergent
and 1 more Tablespoon Glycerine

Important Notes: Distilled water is strongly suggested because tap water (which is usually "hard" water) is not good for bubbles. Also, the more expensive dish soaps tend to work better. Glycerine helps slow down the evaporation of water adding colour to the bubbles. It is perfectly safe to use but too much can make your formula too heavy.
Mix your solution well but if planning to use it soon avoid making a lot of foam. Store in a clean, sealed container. Only pour the amount you need and keep the rest covered so evaporation doesn't thicken your solution. It can be helpful to let it sit 24 hours before using it. I suggest warm water for mixing and room temperature for storing.

Great conditions: After a rain shower. Humidity 70% and higher.
Good Conditions: Cloudy days. Humidity 40%-70%. At dusk, after the sunsets.
Avoid: Direct sunlight. Dusty air. Strong breezes. Foamy build-up (skim it off). Bar Soap.
Remember: Soap solution will sting your eyes. Soap solution is very slippery.

Do you want bigger, better bubbles? Try these bubble tips:

If you get a lot of small bubbles instead of one big one, you are probably blowing too hard or you have the bubble wand too close to your mouth.

Finish your bubble with a quick twist of your wrist to seal it.

Prepare your bubble solution two to three days in advance. Save any extra bubble solution to use later.

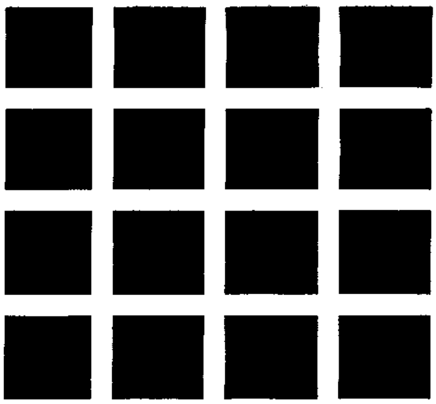
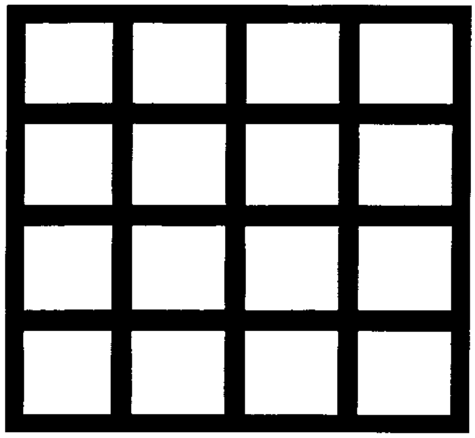
Make sure your bubble maker and anything your bubble may touch is wet.

Let the bubble maker sit in the bubble solution for a few seconds. Don't slosh it around the solution - this creates suds and foam, which are bubble busters!

Look for cool humid days, shady areas. Avoid windy days!

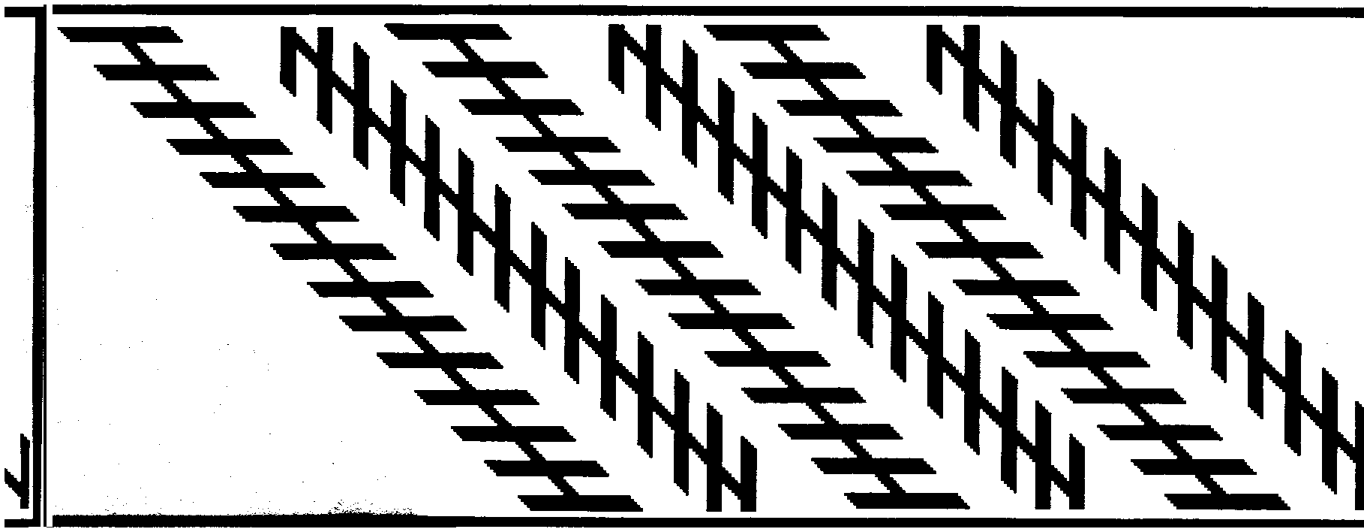
ACTIVITY FIVE: Optical Illusions

Have a look at the following optical illusions and discuss what you see with your partner:

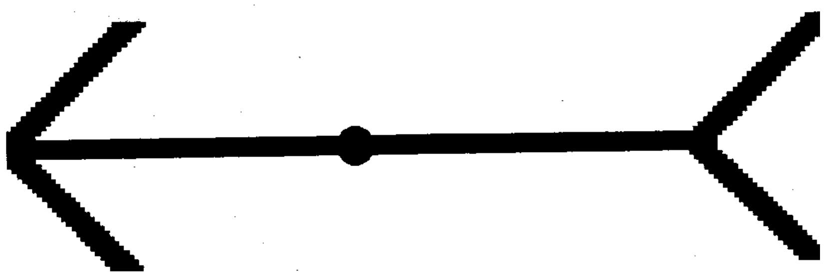
Can you see faint spots at the intersections? Are they really there?

If you look at the frame for a while, your eyes get used to it. When you look at the boxes, your eyes still have this pattern. This is called persistence of vision. It's why television and movie piectures are not continuous. They are made up of over 30 frames per second. The frame pattern is most obvious where the lines cross. We see these as faint spots at the intersections. Now close your eyes and count to ten. Open them and look ***only*** *at the* ***boxes****. Are the faint spots will there?*



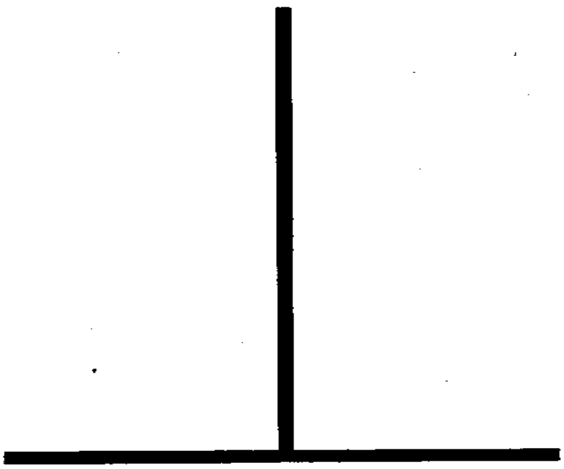
The diagonal lines are in fact parallel. Verify this by checking with a ruler!

We judge things by what is around them (their environment). The diagonal lines are parallel. Some diagonal lines have horizontal lines across them. Other diagonal lines are crossed by vertical lines. Because these crossing shorter lines are not all pointing the same way, our eyes get mixed up.



The dot is located at the exact centre of the horizontal line. Verify this by checking with a ruler.

Notice that the lines at both the arrow's head and tail spread out to the right. At the arrow's head, these lines overlap the arrow's length. This makes the arrow seem to be shorter at its head. At the arrow's tail, the spreading lines go past the arrow's end. This makes the arrow seem to be longer at its tail.



Is the vertical line longer than the horizontal line in this upside-down 'T'? Use a ruler to check your guess.

Our eyes can judge lengths easily if they are only horizontal OR vertical. Our eyes and brain find it hard to imagine turning one line a quarter turn (90^0) accurately.

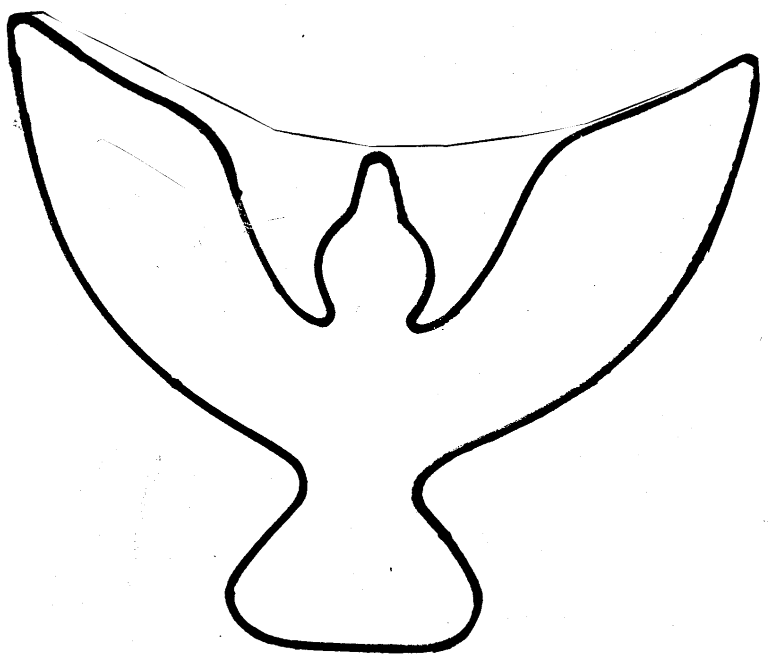
ACTIVITY 6: Microscope Work

Set up some microscopes. Get the students to look at the objects on display on the microscope and draw what they see.

ACTIVITY 7: Make a lava light

1. Half fill the glass jar with water.
2. Pour about 3cm of oil into the jar. When everything settles, is the oil on top of the water or underneath it?
3. Add a drop of food colouring to the jar.
4. What happens?
   Is the drop in the oil or in the water? Does the food colour spread?
5. Sprinkle a teaspoon of salt on top of the oil while you count slowly to 5. What happens to the food colouring? What happens to the salt?
6. Add more salt to keep the action going for as long as you want.

ACTIVITY 8: Balancing Bird



Cut out the picture of the bird. Colour it in.

Place a paper clip on each wing.

Try balancing the bird on your finger.

ACTIVITY 9: Newtons Cradle

Set up a Newtons Cradle. This apparatus demonstrates the conservation of momentum and energy – kids love playing with it!

ACTIVITY 10: King Kong's Hand

1. Open a glove and pour a teaspoon of baking soda into it.
2. Pour 50 mL of vinegar into the beaker.
3. Place the glove containing the baking soda over the beaker filled with vinegar and make sure it is securely fastened on the beaker.
4. Describe what happens.

Why did this happen?

When vinegar is mixed with baking soda, they form new substances. One of these is a gas. We call this making of new substances a ***chemical reaction****. The gas is carbon dioxide. If the glove is securely fastened onto the beaker, it will trap the gas. The glove will inflate as more gas is produced.*

ACTIVITY 11: Sultana Ballet

1. Fill a plastic cup with water until it's about ¾ full.
2. Stir in a big spoonful of baking soda until it is dissolved.
3. Drop a few sultanas into the cup.
4. Pour in two big spoonfuls of vinegar.
5. What happens to the sultanas?

More on carbon dioxide (CO_2)

This is the same reaction as in the last activity. The sultana's skin is wrinkled. The gas bubbles get trapped in these wrinkles. . When enough bubbles are on a sultana, it rises up inside the cup. Since a sultana is light, the air bubbles can carry the sultana upwards. At the top of the mixture, the bubbles burst. The gas escapes into the air. When too many bubbles have escaped, the sultana sinks. If the sultana picks up more gas bubbles, it can rise and repeat the process.

ACTIVITY 12: Rainbow Experiment

1. Fill the glass jar with water.
2. Stir in 10 drops of universal indicator solution.
3. Add a teaspoon of washing soda
4. Add 15mL vinegar
5. Stir with a rotating/swirling action.

What happens?

*Some liquids, like vinegar and yoghurt, tast sour. We say that they contain **acids**. The opposite of an acid is called a **base**. Washing soda is a base. If we mix the correct amounts of an acid and base, they cancel each other out. We then get a mixture that contains **water**.*

Traffic lights tell us whether our cars should go or stop by changing colour. Universal indicator changes colour depending on what it is mixed with.

This indicator is one colour in acid, another colour in water and a third colour is base.

*After Step 2, it shows the colour with **water**.*
*After step 3, it shows the colour when mixed with a **base**.*
*After step 4, before mixing it shows the colour when mixed in an **acid**.*
In Step 5, the colour changes as the base and acid mix and water is formed.

ACTIVITY 13: MAKING AN ACID-BASE INDICATOR From Purple Cabbage

MATERIALS:

Cabbage extract indicator
Transfer pipette (eye dropper) for indicator
7 test tubes 13 X 100mm
Test tube rack

Acid solutions:

Vinegar
Hydrochloric acid solution
Sulfuric acid solution
Lemon juice

Basic solutions:

Baking soda solution
Ammonia
Sodium hydroxide solution
Potassium hydroxide solution

PROCEDURE:

1. Put a small amount of the test solutions in test tubes that are clearly marked, and place them in the test tube rack.

2. Using the dropper, add 3 drops of indicator to each test solution. Observe the color change and compare the test solutions to the indicator alone. Record the color changes in a **DATA TABLE**.

ACTIVITY 14: MOTHBALL MAGIC

Mothballs "sink, rise, sink" etc in solution. (May take 5 - 10 minutes to get going).

NEED: 500 mL measuring cylinder
2 moth balls
Marble chips (6 - 8)
3M HCl (100 mL)
Yellow Food dye (dilute in dropper bottle)
2 L Water

METHOD:

1. Put 450 mL water into 500 mL measuring cylinder
2. Add 6-8 marble chips and 1 drop of food dye.
3. Add 100 mL of 3M HCl.
4. Drop in 2 mothballs.

ACTIVITY 15: THE JAR OVER THE BURNING CANDLE

Candle goes out & the water rises up the jar.

NEED: Candle in a petri dish
Matches
Coloured water
Gas Jar

METHOD:

1. Light the candle and leave for a few minutes
2. Pour 1 cm of coloured water into the dish.
3. Quickly place the jar over the candle and see what happens.

ACTIVITY 16: COLOUR CHANGES

Lead Nitrate + Potassium Iodide

Adding two colourless solutions together forms a bright yellow suspension.

NEED: 0.1M KI (16.6 g/L) (50 mL)
0.1M $Pb(NO_3)_2$ (33.1 g/L) (50 mL)
250 mL screw top jar

METHOD:

1. In a jar, place 50 mL of $Pb(NO_3)_2$ solution.
2. Add 50 mL of KI solution.

ACTIVITY 17: BLUEBOTTLE

A stoppered bottle containing a colourless solution is shaken. It turns deep blue, but reverts to colourless on standing.

NEED: KOH (9g) + Glucose (9g)
250 mL stoppered flask
0.1% Methylene blue.

METHOD: Prepare on the Day.

1. Dissolve 9g KOH and 9G of glucose in 250 mL of water.
2. Add a few mL of methylene blue.
3. Stopper the flask and leave stand for about an hour.
4. Agitating the stoppered flask causes a blue colour to appear temporarily.

Glucose reacts with the methylene blue in an alkaline solution (due to the sodium hydroxide, NaOH, present)The blue colour fades. Shaking the bottle dissolves oxygen from the air. The oxygen turns the methylene blue back to its blue colour. Once the oxygen has been used up, the blue colour fades.

ACTIVITY 18: BURNING $20.00 NOTES

Use a 50:50 solution of ethanol and water. Get a plastic note (any amount from $5 to $100) from an audience member. Carefully wrap the note in the hanky. Soak in the ethanol/water mixture and wring out to remove excess. Holding in the tongs, light up the hanky (careful!) and allow to 'burn' for a few seconds. Put out the flame by placing the hanky in the water. Unwrap the note – it should be unharmed!!

ACTIVITY 19: CHEMISTREE

NEED: empty aluminium drink can
copper sulfate/salt solution (1 tsp $CuSO_4$ + 2 tsp Salt / 1 cup of water)

glass jars

METHOD

1. Cut the top and bottom off an empty aluminium soft drink can. Now cut around and around the can to create a thin continuous spiral. Do not straighten it out as you cut. Now carefully mold the spiral into a cone (Christmas tree shape).
2. Place the cone of aluminium inside a clear glass container which is slightly bigger than the cone. Prepare sufficient copper sulfate/salt solution to completely cover the cone.
3. Leave the Chemistree sit for 24 hours. Since the reaction occurs most rapidly on the freshly cut edges you should have a lovely red chemistree.

ACTIVITY 20: WELCOME POSTER

A message "appears" on a blank poster when it is sprayed or painted with a solution.

NEED:
Large pieces of butcher paper
0.1M $K_4Fe(CN)_6$ (42g/L)
Spray bottle with 0.1M $FeCl_3$ (28g/L)
Goggles
Pins/Blutac

METHOD:

1. Paint a message on the butcher paper with a paint brush using 0.1M $K_4Fe(CN)_6$. Allow to dry.
2. Pin up poster on wall. Put goggles on 2-3 students.
3. Spray poster with 0.1M $FeCl_3$
4. Areas with $K_4Fe(CN)_6$ will appear blue.

ACTIVITY 21: FILTRATION

NEED:
2 glass funnels
filter paper
2 filter stands
2 x 100 mL beakers
$KMnO_4$/water solution (1 - 3 crystals only) (100 mL)
$KMnO_4$/water/NaOH solution (as above with 2g NaOH) (100 mL)
Thick white cardboard square (50 cm x 50 cm)

METHOD:

1. Place filter paper in 2 separate funnels and put in stands.
2. Filter both solutions.
3. Filtrate of $KMnO_4$/water remains the same colour while filtrate of $KMnO_4$/water/NaOH changes to Green.

ACTIVITY 22: BREATHALYSER

Adding alcohol changes solution from orange to blue/green - the basis of the Police Breath Analysis.

NEED: OHP
2 glass petri dishes
Saturated solution of K_2CrO_7 + Conc H_2SO_4 (50 mL)
Ethanol (few mL)

METHOD:

1. Make up a saturated solution of potassium dichromate in concentrated sulfuric acid
2. In 2 petri dishes on an OHP, add 5 ml of this solution.
3. Add 3 mL of 50% ethanol to one of the petri dishes. Colour will change from orange to blue/green. The petri dish with no alcohol added will remain the same orange colour.

ACTIVITY 23: DRY ICE DEMO'S

DEMO 1: INDICATOR/DRY ICE

NEED: Dry Ice Chunks
4 x 600 mL Beakers
2M NaOH
Universal indicator
Phenolphthalein
Blue Litmus
Bromothymol Blue

METHOD:

1. In a beaker, add 1 mL of NaOH to 600 mL water, with sufficient universal indicator to give a good purple colour.
2. Add a piece of dry ice. The result will be white fumes and a colour change over a period of a couple of minutes through to yellow.
3. Repeat steps 1 & 2, using other indicators.

DEMO 2: Extinguishing Candles

4 candles ½", 1", 1 ½" 2", in holders
Water trough with 3-4" sides

- Place the candles across the trough and light them.
- Add Dry Ice and a small amount of water.

The candles will extinguish one by one as the depth of CO_2 increases.

DEMO 3: Squealing Washers

¾" washers or similar.

- Place a pellet/lump of Dry Ice on the bench.
- Press a washer onto the Dry Ice.

The washer will "squeal" as CO_2 escapes from underneath the surface.

DEMO 4: Changing Colours

Water Trough
Universal Indicator

- Half fill the trough with water and add a good squirt of universal indicator and stir.
- Add Dry Ice

The water will turn green when the indicator is added. When the Dry Ice is added, the water will turn through orange to red as the pH drops due to the formation of Carbonic acid.

DEMO 5: Floating Bubbles

Detergent/Bubble solution and ring for blowing bubbles
Trough from above

- Blow bubbles to float over the trough

The bubbles will float over the cloud of vapour visible above the trough.

DEMO 6: Dry Ice Explosion

Coffee tin with well fitting lid.
Face shield

- Place Dry Ice in the can.
- Add water to the can and quickly place the lid onto it, forming a tight seal.
- Stand Back!!

The pressure will build up until the lid is blown off. If the lid doesn't blow, fit the face shield and cover the can with a towel or similar. Lever off the lid and add more Dry Ice or water as needed.

DEMO 7: Balloon

Balloon

- Place several pellets into a balloon.
- Add a small amount of water and tie off the balloon.
- Place on the bench.

The balloon will expand as the Dry Ice sublimes.

ACTIVITY 24: FLAME TESTS

Flame Tests: Bottles of 4 different solutions sprayed into a Bunsen burner flame. Spectacular colours occur. (Strontium Nitrate, Sodium Chloride, Copper Sulphate, Barium Chloride)

This is the reason for the different colours that we see in fireworks or flares. When hot, different chemical elements (here metals) give out different colours of light. With a younger audience get them to vote on what colour it will be: green, blue, red, yellow like they do with the EKKA fireworks.

Strontium nitrate $Sr(NO_3)_2$ **Bright Red**
Copper sulfate $CuSO_4.5H_2O$ **Blue-Green**
Barium Chloride $BaCl_2$ **Green**
Sodium Chloride NaCl, **orange-yellow** of street lights *(DO SEPARATELY AND LAST. It's the most persistent).*

ACTIVITY 25: RED, WHITE AND BLUE

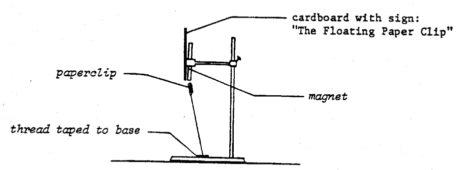
Use 3 large test tubes. Put a squirt of phenolthalein in one, a squirt of lead nitrate in one, and a squirt of copper sulfate in the other. 1/4 fill each test tube with 1M ammonia solution and see the colours. Then add 1/4 of 2M nitric acid to each tube and see what happens.

Phenolphthalein – best on a WHITE back- ground. Add ammonia solution (which is basic) it will go PINK (red). Add nitric acid (CARE)to neutralize the ammonia. The phenolphthalein indicator goes colourless.

Lead nitrate – best on a dark background. Add ammonia solution. A precipitate of white lead hydroxide $Pb(OH)_2$ forms. Adding nitric acid, the Hydrogen ions from the acid dissolve the hydroxide ions and the $Pb(OH)_2$ disappears as it re-dissolves

Copper sulfate – best on a white background. Add ammonia solution. Blue copper hydroxide $Cu(OH)_2$ forms a precipitate. Adding nitric acid redissolves this precipitate (as for $Pb(OH)_2$).

ACTIVITY 26: LEVITATING MAGNET.



Set up retort stand, plasticine, thread, paper clip, and magnet as shown in the diagram.

Be careful that the magnet does not "grow legs and walk"

Place a pair of scissors between the paper clip and the magnet. The steel in the scissors prevents the magnetic field extending to the paper clip and gravity pulls the paper clip down. The scissors become a temporary magnet.

ACTIVITY 27: SLIME TIME

Put cornflour into bowl. Stir in small amounts of water until flour has become a very thick past. Add food colour for a nice colour. Stir slime REALLY slowly. This shouldn't be hard to do. Stir slime REALLY fast. This should be almost impossible. Now punch the slime REALLY hard and fast. Should feel like you're punching a solid.

ACTIVITY 28: MAKING HYDROGEN

Add 3M Hydrochloric acid to a small test tube with a piece of magnesium in it. Use A stopper to collect the gas. Place a lit taper/match at the mouth of the test tube to hear a pop.

ACTIVITY 29: OSCILLATING METHANOL EXPLOSION

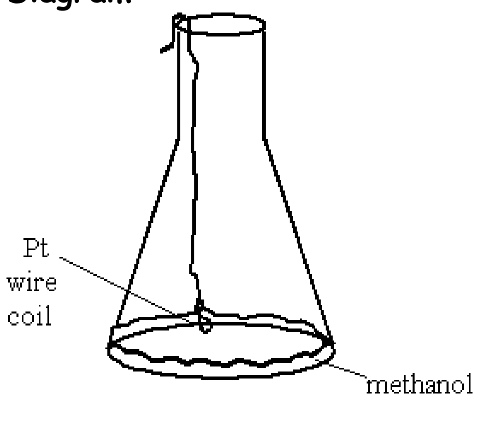
Description: A hot, glowing platinum wire appears to "explode" or poof when placed inside a flask containing a small amount of methanol. After the explosion the wire stops glowing but within about 10 seconds it will start to glow again and then poof....

Concept: Platinum catalyzes the oxidation of methanol. This oxidation occurs on the surface of the platinum wire and causes the wire to glow red. Eventually it will get so hot that there will be a small methanol explosion. The oxygen in the flask is consumed in this explosion, thus stopping the oxidation reaction. When oxygen diffuses back into the flask the oxidation begins again causing the platinum to glow and then an explosion....

Materials:

- Methanol
- 500 mL Erlenmeyer flask
- Copper wire with platinum wire coil on the end
- Bic lighter
- Gloves (for protection against heat)
- Shield

Safety: The explosion is small and should not be dangerous, but wear safety goggles and set the shield between the flask and the students. The flask may get hot, wear gloves to protect hands. The first explosion my startle you, be careful and keep the flask steady
Procedure:
Put 10 - 20 mL of Methanol in flask.
Heat the coiled platinum wire for 10 seconds.
Set the wire on the flask so that the platinum coil is suspended a quarter inch above the methanol in the flask.
Diagram:



Clean-Up: Set the flask in a fume hood and let the methanol evaporate.
Notes: The wire was prepared to hang on the edge of the flask such that the platinum coil will be suspended about a quarter inch above the methanol in the flask.
- Keith Dunn developed this demonstration for Ewing's C100 class.
- There is an in-depth article about this demonstration in the Journal of Chemical Education, vol. 71, no.

ACTIVITY 30: THE OSCILLATING CLOCK REACTION

Description: Three colourless solutions are mixed together. The colour of the resulting mixture will oscillate back and forth from amber to blue for about 5 minutes. The reaction ends as a blue-black mixture with the odour of iodine.

Concepts: The basic concept that this reaction demonstrates is that two reactions can switch back and forth. The product of one is the reactant for the other.

Materials:

- Solution A: (I usually only make 300 mL of each solution unless I know I will use 1 L).

Put 43 g Potassium Iodate (KIO_3) in about 800 mL of distilled water
Add 4.5 mLs of Sulphuric Acid (H_2SO_4)
Stir until KIO_3 is dissolved
Dilute to 1 L

- Solution B:

Put 15.6 g of Malonic Acid ($HOOCCH_2COOH$) and
3.4 g of Manganese Sulphate Monohydrate ($MnSO_4 . H_2O$) in about
800 mLs of distilled water.
Add 4 g of Vitex Starch.
Stir until all is dissolved.
Dilute to 1 L

- Solution C:

(Use only fresh solution B. If you make solution B the day before the demo, store it in the refrigerator.)
Dilute 400 mLs of 30% H_2O_2 up to 1 L.

- 300 mLs of each solution
- 1 L beaker
- Lighted stirring plate
- magnetic stir bar

Procedure:
Put the stir bar into the beaker. Put 300 mL of solutions A and B into the beaker. Turn on stir plate and stir plate light. Adjust the speed to get a large vortex. Put 300 mL of Solution C into the beaker. Be sure to add the solutions in this order or it will not work: A + B and then C.
Safety: Iodine is produced. The vapour and solid are irritating to the eyes, skin, and mucous membranes. Wear safety goggles and gloves. Do this demo in a well ventilated room.

Be careful if you prepare the solutions. Wear goggles and disposable gloves. Sulphuric acid and malonic acid are strong irritants and 30% H_2O_2 is a strong oxidizer.

Clean Up:

Neutralize the iodine by reducing it to iodide. Add about 10 g of Sodium Thiosulfate to the mixture and stir until the mixture becomes colourless. **Caution**: the reaction between iodine and thiosulfate is exothermic and the mixture may be hot. The cooled, neutralized mixture should be washed down the drain with water.

Background:

The BR reaction:

$IO^{3-} + 2\ H_2O_2 + CH_2(CO_2H)_2 + H+ = ICH(CO_2H)_2 + 2\ O_2 + 3\ H_2O$

This reaction is accomplished by two component reactions A and B.

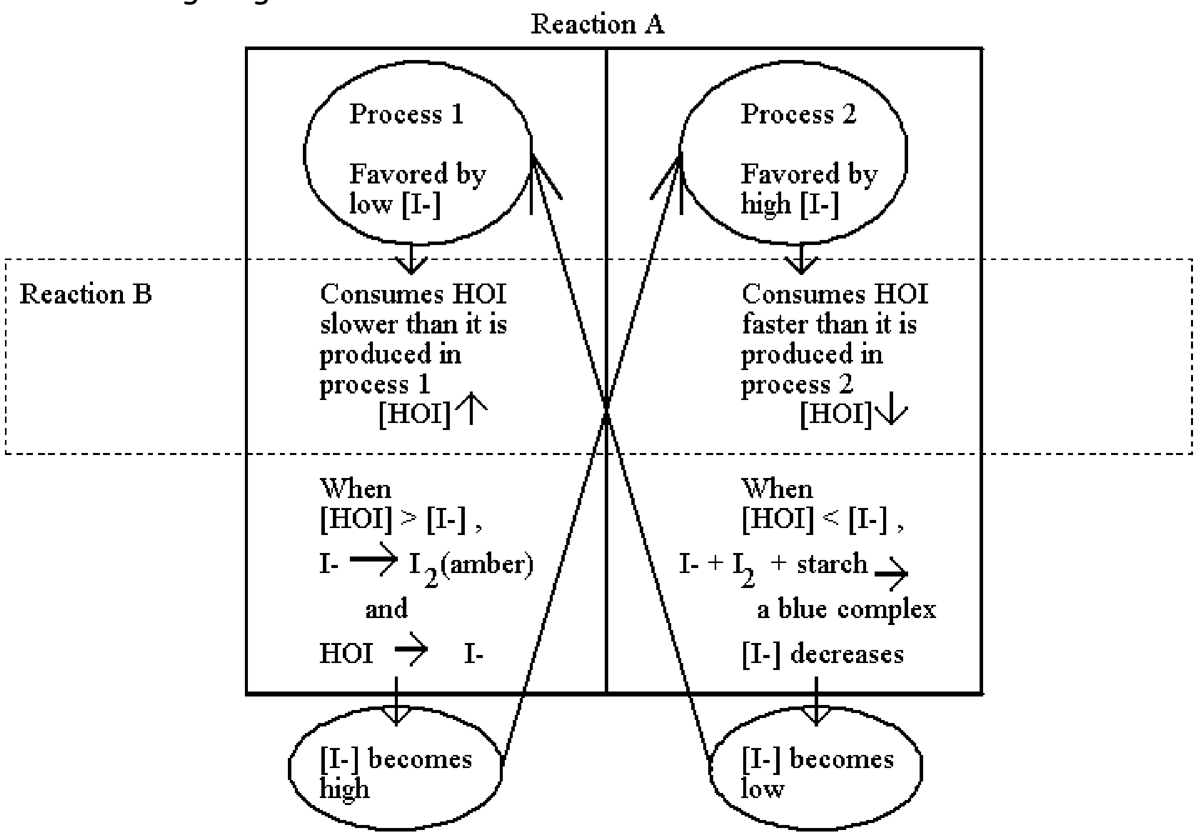
$IO_3^- + 2\ H_2O_2 + H^+ = HOI + 2\ O_2 + 2\ H_2O$ (A)

$HOI + CH_2(CO_2H)_2 = ICH(CO_2H)_2 + H_2O$ (B)

Reaction A can occur via two different processes, 1 and 2. Each process involves several different reactions. The oscillation of the BR reaction is between these two processes. Reaction B connects the two processes. The interactions of the chemicals involved in process 1 and reaction B will eventually bring about conditions that favour process 2 and then process 2 and reaction B will do the same for process 1... thus there is an oscillation between the two processes.

When process 1 and reaction B interact, the amber colour is produced and process 2 and reaction B lead to the blue colour.

See following diagram.



ACTIVITY 31: THE TRAFFIC LIGHT DEMONSTRATION

Procedure:

12g KOH

12g glucose

Indigo Carmine indicator

Dissolve glucose in 1 Litre of distilled water. Add KOH & 50ml of Indigo Carmine indicator. Seal in container & shake well.

Observations:

When the indicator is initially added to the solution, the solution appears green. The colour slowly fades to produces a yellow solution, passing through an intermediate stage in which the solution is red. The green colour reappears when the flask is shaken and then fades to red, then yellow again.

Explanations:

Indigo carmine undergoes a reversible reduction.

Shaking the flask brings more oxygen into the solution, provoking the formation of the oxidized (green) form.

The indigo carmine will eventually undergo reduction again to its reduced (yellow) form.

The intermediate colour is due to formation of a red semi quinone intermediate.

ACTIVITY 23: MAKING BORAX SNOWFLAKES

Do real snowflakes melt too quickly? Grow a borax snowflake, colour it blue if you like, and enjoy the sparkle all year long!

Time Required: Overnight

What You Need:

- string
- wide mouth jar (beaker)
- white pipe cleaners
- borax (see tips)
- pencil
- boiling water
- blue food colouring (opt.)

Here's How:

1. Cut a pipe cleaner into three equal sections.
2. Twist the sections together at their centres to form a six-sided snowflake shape. Don't worry if an end isn't even, just trim to get the desired shape. The snowflake should fit inside the jar.

3. Tie the string to the end of one of the snowflake arms. Tie the other end of the string to the pencil. You want the length to be such that the pencil hangs the snowflake into the jar.
4. Fill the beaker with boiling water.
5. Add borax one tablespoon at a time to the boiling water, stirring to dissolve after each addition. The amount used is 3 tablespoons borax per cup of water. It is okay if some undissolved borax settles to the bottom of the jar.
6. If desired, you may tint the mixture with food colour.
7. Hang the pipe cleaner snowflake into the jar so that the pencil rests on top of the jar and the snowflake is completely covered with liquid and hangs freely (not touching the bottom of the jar).
8. Allow the jar to sit in an undisturbed location overnight.

Look at the pretty crystals!!! You can hang your snowflake as a decoration or in a window to catch the sunlight.

ACTIVITY 33: EXTREME FOUNTAIN

What you need:
. a packet of lollies
. a plastic bottle of softdrink (not orange flavoured - we don't know why, but orange doesn't always work)
. some paper
. a friend who'll lend a hand

What to do:
. roll up the paper into a cylinder that's just wide enough for the lollies to slide through
. put one finger over the bottom of the roll, and get a friend to help you put all the mints into the paper roll
. get your friend to loosen the lid on the soft drink bottle, then hold the roll of lollies just above the bottle and remove your finger so all the lollies drop straight in

. stand back!!!

What's going on:
Soft drinks are full of dissolved carbon dioxide gas. The gas has been forced in there under pressure, and as soon as you open the lid on the drink you can see the gas bubbling out of the liquid and hear it escaping from the bottle.

Bubbles can't just form on their own - they always need a place to start growing. That starting place can be a speck of dust, a bit of uneven surface, or even a lolly. Whatever it is, the starting place is called a *centre of nucleation.*

Adding all those lollies to the soft drink means there are hundreds more centres of nucleation than normal, so the gas comes out as bubbles much more quickly - and the rest is rocket history.

ACTIVITY 34: EXTREME MINI-ROCKET

What you need:
. 1 tablespoon of vinegar
. ½ tablespoon of baking soda (also called sodium bicarbonate, or bicarb soda)
. a plastic film canister with a lid
. a place outside where it doesn't matter if you make a bit of a mess

What to do:
. put the vinegar into the film canister
. add the baking soda and QUICKLY put the lid on, turn it upside down and take cover!
(Make sure you don't point the film canister at anyone including yourself)

What's going on:

Our old friends baking soda and vinegar are at their gas-making best here! When baking soda and vinegar mix, they make carbon dioxide. Gases like carbon dioxide can be squashed down into really small spaces, but that builds a lot of pressure. When enough carbon dioxide gas is made in the canister, the pressure gets high enough to blow the lid off. That's mini-extreeeme!

The first question is, "Where do the bubbles come from?". The answer is to do with what happens when you add the vinegar to the baking soda. When these are mixed together, we get what scientists call a 'chemical reaction' happening between them. This chemical reaction produces a gas called carbon dioxide, which you can see as the bubbles that fizz up when the vinegar is added.

ACTIVITY 35: CARTESIAN DIVER

Is it mind control or just a clever science trick? Explore the science of Cartesian divers while amazing your friends with your telekinetic powers.

Materials:
A plastic soda bottle with a cap, a glass test tube, and some water

Method:
This experiment is named after René Descartes (1596-1650), a French scientist and mathematician who used the diver to demonstrate gas laws and buoyancy.

Experiment:
1. Fill the plastic bottle to the VERY top with water.
2. Fill the glass eyedropper 1/4 full with water.
3. Place the tube into the bottle. The eyedropper should float and the water in the bottle should be overflowing. Seal the bottle with the cap.
4. Squeeze the sides of the bottle and notice how the eyedropper (called a diver) sinks. Release your squeeze and it float back up to the top. Squeeze again and observe the water level in the eyedropper (it goes up). Practice making the diver go up and down without making it look like you're squeezing the bottle. Amaze your friends with your ability to make the eyedropper obey your commands!

How it works:
Squeezing the bottle caused the diver to sink because the increased pressure forced water up into the diver, compressing the air at the top of the eyedropper. This increased the mass of the diver causing it to sink. Releasing the squeeze decreased the pressure on the air at the top of the eyedropper, and the water was forced back out of the diver.

ACTIVITY 27: EXTRACTION OF DNA FROM WHEATGERM

1. Place 1 gram or 1 teaspoon of raw wheatgerm in a 50mL beaker.
2. Add 20mL of hot (50-60°C) tap water and mix constantly for 3 minutes.
3. Add 1mL of detergent and mix gently every minute for 5 minutes. Try not to create foam.
4. Use an eyedropper, pipette or piece of paper towel to remove any foam from the top of the solution.
5. Pour the water/detergent solution into a clean beaker, leaving behind the wheatgerm sludge.
6. Tilt the beaker containing the water/detergent solution at an angle. SLOWLY pour 14mL of chilled methylated spirits down the side so that it forms a layer on top of the water/detergent solution. DO NOT mix the two layers together!

DNA precipitates out of solution at the water-methylated spirits interface as soon as you pour in the alcohol. If you let the preparation sit for 15 minutes or so, the DNA will float to the top of the methylated spirits.

7. Use a glass hook or paper clip or a wooden stick to collect the DNA and place it onto a watch glass to observe.

ACTIVITY 37: THE FRUIT BATTERY

This battery is made from a fruit containing an acid (eg citric acid found in lemons), a piece of zinc and copper, a multimeter to test if the battery is working, and a few insulated wires.

The fruit battery works by converting chemical energy to electrical energy via a redox reaction.

The zinc and copper strips are called electrodes. An electrode is a conductor in a circuit that carries electrons to and from a substance that is not a metal. One electrode produces electrons and the other consumes them. This movement of electrons generates a direct electric current (DC current).

ACTIVITY 38: MAKING ICECREAM

½ cup of cream 4 teasp sugar 5 drops vanilla essence	Place all contents in a small zip lock bag, removing air and sealing well. Place inside larger zip lock bag filled with ice and ½ cup salt. Seal and knead And shake for 10 – 15 mins until the right consistency is reached.

ACTIVITY 39: FOAM COLUMNS

Preweigh ~5g of manganese dioxide, potassium iodide and potassium dichromate into small containers. Premeasure ~ 50 mL of 100 volume H2O2 into small bottles. Put ~ 10 mL of detergent from a dropper bottle into each measuring cylinder. Add the solids and swirl to mix. When ready to show audience, set up measuring cylinders and add H2O2 and stand back!

ACTIVITY 40: MAKING SHERBERT

1 teaspoon citric acid
½ teaspoon bicarb soda
4 teaspoons icing mixture
1 teaspoon jelly crystals

Measure ingredients into paper bag & shake well to mix… Give it a taste! Sherbet is a chemical reaction happening on the tip of your tongue, It contains an acid & an alkali, when They hit water – or saliva – BANG Together that's what gives sherbet Its' fizz!!! …SIZZLING SCIENCE AT ITS TASTIEST!!!!!...

ACTIVITY 41: BISCUIT MINING

Aim: TO USE A VARIETY OF BISCUIT TYPES AND EXTRACT THE MINERALS USING DIFFERENT MINING METHODS, THEN EXAMINE THE IMPACT OF YOUR METHOD IN RELATION TO COSTS, BENEFITS AND IMPACTS ON THE ENVIRONMENT.

Materials:

- SAMPLES OF CHOCOLATE CHIP, AND FRUIT PILLOW BISCUITS.
- VARIETY OF MINING TOOLS INCLUDING SCISSORS, PADDLE POP STICKS, DRAWING COMPASSES, TOOTHPICKS, SMALL SPATULAS, BEAKERS
- SCALES

Procedure:

1. DECIDE WHICH MINING METHOD YOU WILL USE (LEACH, OPEN CUT, STRIP, UNDERGROUND) TO EXTRACT THE MINERALS FROM EACH BISCUIT. REMEMBER THAT, BEFORE MINING COMPANIES BEGIN TO MINE, THEY CHOOSE APPROPRIATE MINING METHODS AND PLAN HOW TO MANAGE THEIR IMPACT ON THE ENVIRONMENT. RECORD THIS IN THE TABLE AND BRIEFLY DESCRIBE YOUR PROCESSES.
2. EXTRACT THE ORE USING THE TOOLS PROVIDED.
   - THE BISCUIT MUST REMAIN FLAT ON THE TABLE AT ALL TIMES
   - YOU ARE UNABLE TO LIFE OR TURN THE BISCUIT.
3. SORT THE ORE INTO SEPARATE PILES.
4. WEIGH THE ORE AND RECORD THE RESULTS.
5. PUT THE BISCUIT BACK TOGETHER TO REHABILITATE YOUR MINE SITE.
6. REPEAT USING ANOTHER BISCUIT AND/OR MINING METHOD.

Results

Biscuit Type	Mining Method	Environmental Management	Original Weight Of Biscuit	Amount Of Ore Produced

Conclusion:

1. FOR EACH BISCUIT TYPE, WHICH METHOD OF MINING PRODUCED THE MORE ORE?
2. FOR EACH BISCUIT TYPE, WHICH METHOD WOULD BE MOST PROFITABLE?

3. WHAT ENVIRONMENTAL MANAGEMENT ISSUES MIGHT THERE BE WITH DIFFERENT METHODS OF MINING?

4. HOW MIGHT MINING COMPANIES ATTEMPT TO ADDRESS THESE ISSUES?