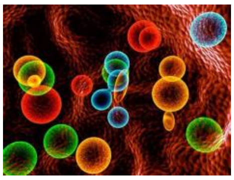
# Science @ Home

Some simple experiments to develop your childs scientific skills and encourage critical thinking.

**Please note: Science can be dangerous so make sure all experiments are supervised by a responsible adult.**

Produced by L. Walker

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## Experiment 1

**Title:** Bending water

**Aim:** To find out how electricity affects water.

**Apparatus:**

- A balloon
- A head of hair
- A running tap

**Method:**

1. Blow your balloon up and rub it on your hair.
2. Turn the tap on so that a tiny trickle of water is coming out.
3. Move the balloon close to the water trickle.

**What's going on?**

When you rub the balloon on your hair you build up a negative charge on the surface of the balloon. When you move the balloon close to the water it attracts the positive charges in the water causing the water stream to bend towards the balloon. This happens because charges that are different attract one another; think of the different poles of two magnets attracting one another.

Experiment 2

Title: Cloud in a bottle

Aim: To investigate how water vapour becomes a cloud.

Apparatus:

- A clean plastic bottle
- Water
- Matches

Method:

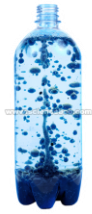
1. Fill the bottom of the bottle with a little water (about an inch and a half) and close the lid
2. Leave the bottle alone for 20 minutes
3. Squeeze and release the bottle (nothing happens)
4. Open the lid of the bottle
5. Quickly light a match and blow it out and put the smoking end into the bottle.
6. Repeat step 4 and try to keep as much smoke in the bottle as possible
7. Close the lid
8. Squeeze the bottle and release
9. Repeat step 7 until you can see a small cloud form in the bottle

## What's going on?

Before water vapour can become a cloud, it has to have something to condense around and it needs to cool so that it can condense. By adding the smoke to the bottle you're giving the water vapour something to condense around. You cool the gas by making it rapidly expand when you release the bottle after squeezing it. This cooling allows the water to condense around the smoke particles and form tiny droplets.

Experiment 3

Title: Household lava lamp



Aim: To make your own lava lamp

Apparatus:

- Clean plastic bottle
- Cup of water
- Food colouring
- Vegetable oil
- Alka seltzer tablet(s)

Method:

1. Add the food colouring to the water
2. Pour the water into the bottom of the bottle
3. Pour the vegetable oil on top of the water
4. Wait a few minutes for the oil and water to separate
5. Break the Alka-Seltzer into pieces and add bit by bit into the bottle
6. Add more Alka-Seltzer as needed

What's going on?

Water molecules and oil molecules cannot bond together and so do not mix. Oil is less dense than water and so will float on top of the water. This creates the layered effect in the bottle. When the Alka-Seltzer reaches the water, it reacts with the water producing gas. As the gas bubbles rise to the surface, the bubbles trap water and cause it to rise to the surface. Since the water is denser than oil, when the bubble bursts the water sinks back through the oil.

Experiment 4

Title: Red cabbage indicator

Aim: To make our own indicator using red cabbage.


Apparatus:

- Red cabbage
- Boiling water
- Bowl
- Knife (or food processor)
- Plastic bottle
- Plastic cups (or you can purchase plastic test tubes from amazon)
- Vinegar
- Bicarbonate of soda

Method:

1. Cut up the cabbage into small chunks
2. Put the cabbage in your bowl/saucepan and just cover with boiling water
3. Leave the cabbage to soak for 20 minutes
4. Drain the now purple water from the cabbage !!! BE CAREFUL THE WATER WILL STAIN !!!
5. Pour a small amount of the cabbage water into 3 plastic cups
6. Add some vinegar to one of the cups until you see the colour of the water change

7. Add a little bicarbonate of soda into one of the cups whilst mixing gently
8. You should have one cup of purple water, one cup of red water (vinegar) and one cup of blue water (bicarbonate of soda)

## What's going on?

The pigment which gives red cabbage its distinctive colour is what's known as an indicator. An indicator is used to determine whether a substance is an acid or an alkali. When you add vinegar, which is an acid, to the water the indicator changes colour. Bicarbonate of soda is an alkali so the indicator changes to a different colour when you add them together.

## Extension task:

See what happens when you add some vinegar to the blue water (with the bicarbonate of soda in it) – the sink or outdoors is a good location to do this. How does this affect the colour of the water? Can you get the water to return to its original colour by mixing vinegar and bicarbonate of soda?
Check other household items to see if they're acid or alkali e.g. anti-acids, pineapple, coke, tea, oranges, cucumber, water.

Experiment 5

Title: Cartesian diver

Aim: To investigate density

Apparatus:

- Clean empty plastic bottle
- Pen lid (without holes)
- Blu tack

Method:

1. Fill the bottle with water right to the very top
2. Put a small amount of blu-tack on the bottom of the lid. Make sure you don't cover the hole.
3. Put the lid in the bottle blu-tack first, it should just be floating, remove or add blu-tack so that this is the case
4. Close the lid
5. Squeeze the bottle and watch the lid sink

What's going on?

When you squeeze the bottle, you force water further into the pen lid. This compresses the air in there causing it to become more dense. The air is now denser than the water and the pen lid sinks. When you release the bottle the water sinks down again and the air becomes less dense. The pen lid floats once more.

## Extension task:

Stand the bottle in the fridge for 20 minutes, how does this effect the dive (remember that cooler liquids are more dense than warmer liquids)?
What if you use warmer water?

Experiment 6

Title: Chromatography

Aim: To investigate colour mixing

Apparatus:

- Paper towels/kitchen roll
- Scissors
- Bowl/Cup
- Tape
- Coloured pens (make sure they are soluble ink)

Method:

1. First, cut the paper towel into strips about 2cm wide. Then draw a dot or squiggly line with one of your pens about 2cm from the bottom of the strip.
2. Do the same for your other colours of pens and make sure you label them so you know which colour is which.
3. Hang the strips over the side of the bowl/cup of water. The water should touch the very end of the paper towel, but not the ink.
4. Tape the paper towel strips in place and observe to see what happens.
5. Are there any colours of pens that behave differently to others?

What's going on?

When the paper towel is dipped in water, its particles absorb the water and it gets wet. When the water reaches the ink, it dissolves some of the dyes in the ink, and the dyes travel up the paper towel with the water. That's how you can see all the different colours that make up the ink.

Extension task:

Try it out with different types of pens, does a scented pen make the same pattern as a non-scented pen? What happens if you use a whiteboard marker?

Experiment 7

Title: Penny Cleaning

Aim: To investigate reactions involving the element copper.

Apparatus:

- Copper coated coins
- Ungalvanised steel nail (for the extension task)
- 3 x Bowls
- Measuring jug
- Table salt
- Kitchen towel
- Distilled vinegar
- Teaspoon

Method:

1. Put the ten coins in a bowl.
2. Pour enough vinegar into the bowl to cover the coins. Vinegar contains a chemical called acetic acid, which will react with the coins.
3. Now stir in half a teaspoon of salt, and leave for ten minutes. Salt is made of the elements sodium and chlorine.
4. Now take the coins out and note any changes to their appearance you can observe.
5. Remove the coins from the vinegar and salt mixture (keep this aside as you need it for the next experiment). And put them somewhere safe.

What's going on?

Everything around you is made of tiny particles called atoms. Atoms of different kinds (elements) join together in different ways, forming compounds. In a chemical reaction, atoms can separate, swap partners, and form new compounds. Copper coins are shiny when new but turn dull brown over time because the copper atoms react with oxygen atoms from the air to form a compound called copper oxide. Vinegar contains a compound called acetic acid, which splits in water to release positively charged hydrogen atoms. These react with the copper oxide, stripping it from the coins and revealing the shiny layer of pure copper underneath. Salt speeds up this reaction.

Extension tasks:

1. Copper plating –
    - Use the vinegar and salt solution from the first experiment (it contains the copper from the coins) and put the steel nail into the solution.
    - Leave it for twenty minutes and your nail should have changed colour.

What's going on? – Steel is a mixture of several different elements, but is made mainly of iron. Some of the iron atoms from the nails surface dissolve in the solution – and some of the copper atoms from the solution attach to the nail instead. This is why the nail turns copper coloured.

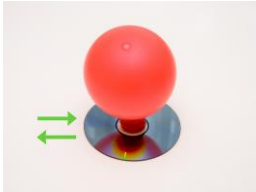
2. Making copper chloride –
    - Place a folded up piece of kitchen towel into a clean bowl.
    - Soak the kitchen towel in vinegar.
    - Put one of the copper coins into the bowl with the vinegar soaked kitchen towel.
    - Spoon salt on top of the coin, until the coin is completely covered.

- Leave it for approximately two hours. You should see a green coating of copper chloride. **Wash your hands after touching the coin.**

<u>What's going on?</u> – When you leave a copper coin covered with salt and vinegar for a long time, a chemical reaction takes place. Salt is made of the elements sodium and chlorine. The chlorine reacts with the copper, producing a chemical compound called basic copper (II) chloride. This compound has a bright blue-green colour.

Experiment 8

Title: CD hovercraft



Aim: To investigate how air reduces friction.

Apparatus:

- Water bottle top
- Blue-Tac
- Balloon
- CD or DVD (that you don't mind if it gets scratched)

Method:

1. **Roll** the Blue-Tac into a sausage shape and press it down onto the CD, in a circle. Push the bottle top down onto the CD so that it sticks to the CD with no gaps for the air to escape.
2. Blow up the balloon pretty full and then twist the bottom round several times (so the air doesn't all come out while you're attaching it to your hovercraft base!)
3. Let's take your hovercraft for a test drive! Stretch the balloon over the bottle top, untwist the balloon and you're off. Try pushing your hovercraft gently and watch how far it glides!

What's going on?

Why do hovercrafts glide so effortlessly? It all has to do with friction, or lack of it! As the air comes out of the balloon it spreads out under the CD so the hovercraft isn't actually touching the table but floating just above it on a cushion of air!

Extension tasks:

- Try adding weight to your hovercraft, maybe more Blue-Tac, how does that change things?
- What about blowing the balloon up more, or less?
- Can you find a way to extend your hovercraft, make the base even bigger, how does that change things?

Experiment 9

Title: Blubber glove

Aim: To investigate how sea mammals stay warm in ice cold water.


Apparatus:

- Vegetable or sunflower oil
- Scissors
- Duct tape (or heavy duty sellotape)
- Two small kitchen bags with seal tops
- Large bowl of icy water
- Timer
- Funnel or measuring jug.

Method:

1. Turn one of the small kitchen bags inside out.
2. Put your hand inside the inside out bag and then put it into the other kitchen bag. The "zip" on the inner bag faces outwards and the zip on the outer bag faces inwards.
3. Press the zips on the two bags together to create a seal. Make sure you leave one part unsealed.
4. Apply tape to the parts of the bags you have "zipped" together and fold it over to seal them together. **Do not tape over the gap you left.**
5. Put the funnel's spout into the gap (or use the measuring jug to pour into the gap if you don't have a funnel) and carefully pour in enough oil to fill the bag two-thirds full.

6. “Zip” the gap up, and use another piece of tape to cover it, sealing in the oil. Fold over the tape.
7. Hold one hand into the icy water, and time how long you can leave it in there before it becomes uncomfortable.
8. Wait a few minutes for your hand to return to normal temperature, now put it inside the inner bag. Now plunge your hand, inside the blubber glove, into the icy water. Time how long you can keep your hand in the water now, and compare it with the time you recorded before.

What’s going on?

When you plunge your hand into the icy water, heat flows quickly from your skin to the water, and you feel the cold almost instantly. When you use the blubber glove, the layer of oil around your hand slows down the loss of heat - because heat flows more slowly through the oil. Materials through which heat passes slowly are called insulators. Like oil, air is a good insulator. Mammals such as seals, whales and dolphins have a thick layer of fatty tissue called blubber. Blubber slows down the loss of heat from their bodies – which is crucial in helping them to survive the icy Arctic or Antartic conditions.

Extension task:

- Take 3 bowls and fill one with cold water, one with warm water and one with tepid (luke warm) water.
- Keep one hand in cold water for a few seconds, so it cools down and the other in warm water, so it heats up.
- Then put both hands in the tepid water. How do they feel?

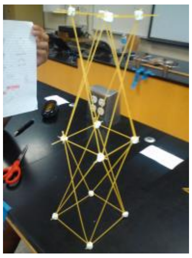
What’s going on?
The hand that was in the cold water will feel warm and the hand that was in the warm water will feel cold, as heat flows either to or from each hand.

Nerve endings in your skin give you your sense of hot and cold. They don’t actually detect actual temperatures – instead they sense the loss or gain of heat energy from your skin.

Experiment 10

Title: Spaghetti tower

Aim: To investigate how we make structures stable.



Apparatus:

- Marshmallows
- Spaghetti

Method:

1. Begin by making a square. (pushing the spaghetti into the marshmallows to create the shape). Push the shape gently. Is it strong? Does it lean easily?
2. Make a cube. Try twisting it gently. Does it lean easily? Is it stable?
3. To make the cube stronger, add diagonal pieces. To fit them, first make the cube smaller by sliding the marshmallows inwards so the spaghetti strands poke out the other side.
4. Add the diagonal pieces (called braces) across each face from corner to corner.
5. Strengthen the vertical edges by feeding a second piece of spaghetti down through the marshmallows at the top corners.
6. Make a roof, starting with a triangle. Do you notice this is stronger than a square? Why do you think this is? Add more spaghetti and marshmallows to form a pyramid with a square base.

7. Build a second braced cube and fix it carefully on top of the first one. Then, continuing to be careful, fix the pyramid on top. Your tower is now complete!

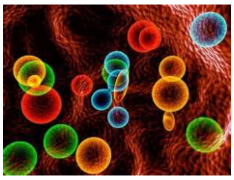
<u>What's going on?</u>

Triangles are the key to the strength of your tower. Unlike a square, which can lean over and turn into a parallelogram when pushed, a triangle can't change shape and so remains upright and rigid. The base of your tower must also be wide. All objects have something called a centre of gravity. This is the midpoint of an objects mass, ie where all its mass appears to be concentrated. Objects that are stable have their centre of gravity within their base. If an object leans so much that its centre of gravity is outside the base, it will fall.

<u>Extension task:</u>

Now you have mastered the art of building spaghetti towers why not try different designs? Can you make a tower as tall as you?

# Lab Report


**Aim (What are we trying to find out?):**

**Apparatus (Materials - what do we need for the experiment?):**

**Hypothesis (What do we think will happen? This is our scientific guess):**

**Method (Steps to do the experiment):**

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**Observations (What did we see happen?):**

**Conclusion (What ended up happening and why?):**

**Evaluation (How could we make the experiment better next time?):**

**Drawings/Photos of experiment**