Northern Irish Enterprise Awards 2023

Science2Life

Most Innovative Children's Science Workshop Provider Northern Ireland

# A VIRTUAL SCIENCE2LIFE EXPERIENCE

An interactive event designed by Science2Life to encourage children to:

- discover the amazing world of science and
- to perform engaging activities that show how science is at work in their everyday lives.

## The Next Best Thing to a Live Show!!!

**An Innovative, Friendly, Learning Experience**

**Flexible Learning**

**The Science Show is Interactive!!!**

Susan Carvell BSc Hons PGCE CEd DASE MEd FInstP
www.science2life.com

Dear Teachers

## Science of Dragons – A Virtual Science Experience

The most exciting part of this Virtual Experience is the fact that you, the teacher, is now in charge! You can stop and start the video to check on your children's understanding, to repeat a section they really enjoyed and to carry out one of the 5 experiments this interactive session requires volunteers for!

## There is no set timetable to adhere to.

You may choose to split the viewing of the show over several days; you may want to choose more volunteers than I ask for, or to allow the whole class to do the activity!

The show video can be up-loaded on to your school's preferred learning platform. It can be shown to individual classes or to larger groups in the school hall (when this is permitted) and can even be shared with parents!

This teacher guide is supported with a guidance video which runs through the equipment required and the 'how to do' sections of the experiments which use volunteers. This video was sent to you at the same time as these notes and the show video.

**All of Science2Life's STEAM ACADEMY shows and workshops are designed to not only motivate and fire the spirit of discovery within your children but also ignite curiosity in their minds.**

The contents of the interactive kit boxes have been chosen so that they can be readily purchased by yourselves from supermarkets or pharmacies – you will also find links within this teacher's guide that takes you to our own Science2Life Online Store .

Visit our website (www.science2life.com) to find out about our other Virtual Experiences:

- Science of Bubbles
- Supermarket Science
- Mysterious Microbes &

There are no time limits set on when you can share this virtual experience with your children.

**FANTASTIC VALUE FOR MONEY!**

# Index

## Content

# A bit about Sue

Sue began her career as a teacher of Physics and Chemistry in 1991. After graduating with a Masters in Educational Studies. She left the classroom in 2000 to join the start-up management team of the world-renowned science centre W5 whowhatwherewhenwhy, which opened its doors to the public in 2001, with the responsibility for all Educational Programmes. During this period, she was awarded a Fellowship for the Institute for Physics in recognition for her work within the field of physics education.

Sue left W5 in 2006 to start her own business Science2Life. A company which brings highly interactive and innovative STEAM focussed shows and workshops to schools, colleges and special events.

Science2Life also provides teacher training sessions.

Sue has performed and delivered her educational programmes and training sessions throughout Ireland and the United Kingdom but also to countries further afield such as Switzerland, Saudi Arabia, Nigeria, United Arab Emirates and Qatar.

In 2015 in partnership with the N Ireland Science Festival and the Royal Society of Chemistry Sue led the Class of 1339 students which gained the Guinness World Record for the Largest Practical Science Class!

Science2Life now offers virtual programmes such as this one. You will find information about the current Virtual Experiences in Scientific Sue's STEAM Academy at the end of this teaching guide.

The virtual teaching process is as new to you as it is to us –

For questions around this Virtual Experience, you can contact Sue via email or telephone:

scientificsue@science2life.com +44 7970 884728

# A bit about the Show

The Science of Dragons Show is based on the books written by Cressida Cowell and the subsequent films based on these books by DreamWorks.

Cressida never mentions the words science or engineering in her writing, however the activities she gets her young Vikings and Dragons to undertake and do, allow us to cover a huge amount of science and technology in a fun, creative and engaging way. In all formats of her Science of Dragons Show Sue aims to show that Cressida is not only a fantastic story-teller but also a secret scientist!

All of Sue's virtual shows are interactive – The Science of Dragons Show has 5 opportunities for volunteers to get involved.

The cartoon symbol of children lets you know the number of volunteers Sue needs per interactive session.

## Science and Literacy

Quite a lot of your children will have seen the film or cartoons of How to Train a Dragon – quite a lot will not have read the books. This activity can also be used as a way to encourage them to start reading for pleasure. There is a strong association between the amount of reading for pleasure children say they do and their reading achievement (Twist 2007). It has also been found that children who read for pleasure make significantly more progress in vocabulary, spelling and mathematics than children who read very little (Sullivan and Brown 2013)

This show is made up of the following 9 Sketches:

1. Catching a Dragon
2. Training a Dragon
3. A Moody Dragon - Experiment 1 – *2 volunteers*
4. Now You See Me… - Experiment 2 – *2 volunteers*
5. Fog Breathing Dragon
6. Vomiting Dragon - Experiment 3 – *1 volunteer*
7. Fire Starting Dragon - Experiment 4 – *1 volunteer*
8. Fire Fighting Dragon - Experiment 5 – *1 volunteer*
9. Fire Breathing Dragons

It is strongly recommended that you watch the teacher guidance video and the show video before you before you engage in this activity.

Each activity will allow you to explore and engage in many of the science process skills and can be extended into investigations which will allow you to conduct fair tests in fun and creative ways.

# THE 6 SCIENCE PROCESS SKILLS

Scientists engage in procedures of investigation to gain knowledge of natural phenomena. The tactics and strategies, the skills scientists use in their pursuit of understanding can be broken down into 6 Science Process Skills, and engagement with the activities in all of **Science2life's STEAM ACADEMY** workshop kits will help to naturally develop these skills within your children:

**Observing**
This is the most basic skill in science. Observations are made by using the 5 senses. Good observations are essential in learning the other science process skills.
One of the best things we can do for our children's science learning is to help them *observe more closely* – look for more details. **We do this by asking questions**.

**Communicating**
It is important to be able to share our experiences. This can be done with photographs, videos, graphs, diagrams, maps, and of course, the spoken word.
Observing and communicating those observations go hand-in-hand. Children need to learn lots of adjectives. Words that are used to help describe or give description to people, places, and things. These descriptive words can help give information about size, shape, age, colour, origin, material, purpose, feelings, condition, and personality, or texture.
**When talking with a child about what they observe, we often teach new vocabulary**.

**Measuring**
Measuring is important in collecting, comparing, and interpreting data. It helps us classify and communicate with others. The metric system should be used to help understand the scientific world.
Measuring is a special case of observing and communicating. Observing how big something is by measuring it against something else, and then communicating that information to someone else using commonly agreed upon units.

**Classifying into Groups/ Sorting**
After making observations it is important to notice similarities, differences, and group objects according to a purpose. It is important to create order to help comprehend the number of objects, events, and living things in the world.
One way of classifying is putting things in order say by lining them up from smallest to biggest or sorting them by colour, or if dealing with liquids, runniest to thickest.

**Inferring**
An inference is an explanation or interpretation based on an observation. It is a link between what is observed and what is already known.
We observe with all five senses, but we interpret what we sense based on our prior experiences and knowledge. Observation results can be called data or facts. **The inference is what those facts mean.**

**Predicting**
What do you think will happen? It is an educated guess based on good observations and inferences about an observed event or prior knowledge.
Predictions are always based on data. We identify trends in the data which let us predict what will happen. Predictions can be tested: if I do X, does Y happen?

# FAIR TESTING

Conducting a fair test is one of the most important ingredients of doing good, scientifically valuable experiments, and is most probably the one most of us remember from our own science lessons.

> Change one variable to see its effect on another, whilst keeping all others the same

Fair test questions involve making comparisons, often trying to find out which is the 'best' or 'most'. Through fair testing, children are encouraged to see that one thing has an effect on another, identifying the differences they have noticed and exploring all the variables (any factor subject to change) that may have an effect. Children decide which variable to investigate and how to measure or observe the effects.

In most experiments we usually start with a question; questions suitable for experiment 5 (Making carbon dioxide gas) could be:

- What other household chemicals react with baking soda to produce carbon dioxide gas?
- How can we measure the volume of carbon dioxide produced?
- How does the amount of baking soda affect its reaction with citric acid or vinegar?
- Does the temperature of the water (for citric acid) or vinegar affect the rate of reaction?
- What effect will different vinegars have on the baking soda/vinegar reaction? Will the balloon blow up more?

What are the variables? To answer this, you need to think about all the factors that could change in the experiment. When you carry out the experiment all of these factors should be the same except the one you are testing.

**Scientists call the changing factors in an experiment - VARIABLES**

So, in a nutshell, fair test experiments require us to observe and measure the effect changing one variable has on another whilst keeping all other variables the same.

The variable you choose to **deliberately change is called the independent variable**. Whilst carrying out the experiment we want to find out what effect this change has on another factor – **we call this factor the dependent variable**.

You can think of the independent variable as being the '**cause'** of the change and the dependent variable as being the '**effect'** that the change you make has during the experiment. In other words, **the dependent variable is the thing that changes as a result of you changing something else.**

Fair testing is not the only key practice a good scientist should know, in fact, there are five approaches that children need to learn to recognise and use: **fair testing; observing over time; pattern seeking; identifying and classifying; and research.**

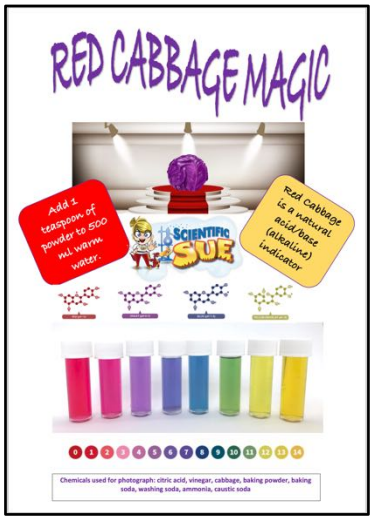
# Items in your Science of Dragons Experience Box

| Item | Quantity | Item | Quantity |
|---|---|---|---|
| Dried Red Cabbage | 15 ml | Dragon Templates | 30 |
| pH Colour Card | 1 | Adhesive Magnetic Dots | 60 |
| Citric Acid | 100 g | Ceramic Magnets | 30 |
| Baking Soda | 200 g | Metallic Paper Clips | 300 |
| Balloons | 10 | | |
| Small Candle | 1 | 500 ml Plastic Bottle | 1 |
| Box of Matches | 1 | FriXion Colour Felt Pens (pack of 6) | 1 |
| Dried Yeast | 56 g | | |
| 200 ml 6% or 9% Hydrogen Peroxide | 1 | | |
| Wooden Splints | 10 | | |

# Experiment 1: The Colour Changing Dragon

## What you have:

- Dried Red Cabbage
- pH Colour Chart
- Citric Acid
- Baking Soda




## What you need:

- Water
- 500 ml Jug
- 2 Clear Beakers
- 2 Tablespoons
- Measuring Spoons
- Safety Glasses x 2


## You may also wish to gather:

- Washing soda
- Lemon juice
- Toothpaste
- Vinegar
- Ammonia
- Baking powder
- Cucumber


## SAFETY:

Safety glasses to be worn by volunteers when mixing the 2 solutions together to prevent any splashes going into their eyes.

None of the chemicals are for human consumption.

If any splashes land on your volunteer's hands, make sure they wash their hands thoroughly after the demonstration.

## Red Cabbage (Brassica Oleracea L.) Powder

Whether or not you like to eat red cabbage, you are going to love experimenting with it. This dried cabbage powder will allow you to make your own **red cabbage pH indicator**. This is a very magical kitchen chemistry activity.

Making a red cabbage indicator is a fantastic STEAM activity to introduce children to acid/base chemistry.

## What is red cabbage?

Red cabbage is a cruciferous vegetable of firmly packed dark red-purple leaves. It belongs to the brassica group of vegetables along with Brussels sprouts and kale, and has a peppery taste and crunch when eaten raw, and becomes sweeter and softer in texture when cooked.
Red cabbage is grown in Europe and is in season from September to December. As the plants grow, they form tight balls of leaves in the centre surrounded by much larger green-purple leaves. When the red cabbage is ready for harvesting, the whole plant is picked and the outer leaves discarded, leaving just the cabbage head – the part we eat.
Red cabbage has a good mix of vitamins and minerals, especially **folate**, which is essential during pregnancy and also helps the body to **produce red blood cells**. It also contains **vitamin C**, which helps protect our cells by **acting as an antioxidant**, and **potassium**, which we need for a **healthy heart**.
A **2019 study** indicates growing evidence that anthocyanins play a positive role in cardiovascular health and that those who eat foods with anthocyanins have a lower risk of heart attacks and heart disease-related death.

### How to use

Add the content for the sachet to 500 ml of warm water. Let the juice cool.

Want colours darker? Use less water
Want colours lighter? Use more water

Pour the liquid through a sieve or tea strainer to remove the rehydrated pieces of cabbage.
Your juice is now ready to experiment with.
Red cabbage - which is purple! - is a natural acid/base indicator
If you don't use it all – freeze it. I pour mine into ice cube trays and then use one cube at a time.

## Nuts & Bolts

The purple colour in the red cabbage comes from a class of pigments called anthocyanins; this pigment is also found in the skin of red apples, grapes, plums and is the pigment in leaves which turn red in the autumn.

### Secrets for Success

**Prepare your cabbage juice before the show.**

- Put a teaspoon of cabbage powder into a beaker

- add 40 ml of warm water to the powder.
- Stir then leave for 10 minutes.
- Using a tea strainer of piece of cloth to separate the now rehydrated cabbage from the purple juice
- **Pour the purple juice into a bottle or jar and label it 'Dragons Drool'**

## For fresh cabbage:

- Chop up the red cabbage, place it in a saucepan
- Add just enough water to barely cover it.
- Bring the water to the boil, and simmer for about 15 minutes.
- Pour the water through a sieve. This purple water is your indicator dye – store in a clear plastic drinks bottle.

Can't find purple cabbages in the shops? Click on this link to buy dehydrated powdered cabbage from the Science2Life online store

### Testing the indicator

Add ½ tablespoon of citric acid to a beaker half filled with water beaker and hand this to assistant 1. Half fill the second beaker with water and add 1 tablespoons of bicarbonate of soda (baking soda) to it and stir; hand this beaker to assistant 2. The amount of showmanship is up to you but make sure you highlight the fact that the citric acid (or vinegar) is an acid and the baking soda is a base (which when dissolved in water makes an alkali solution).

Get your audience to guess what will happen when a squirt of the purple-coloured cabbage juice is added to each of the beakers. The bicarbonate of soda solution (alkali) will turn the cabbage water a greeny-blue colour. The Citric acid and/or vinegar (acid) will turn the cabbage water a reddish-pink colour. The cabbage dye behaves as an indicator; a chemical substance which changes colour, depending on the acidity or alkalinity of its environment.

Finally ask which assistant should pour the contents of their beaker into the other assistants' beaker – you could mention here that there is a strong possibility that a reaction will occur and the size of the reaction might depend on which beaker is poured first - just adding to the excitement!

## Science in a Nutshell

When atoms (or groups of atoms) lose or gain electrons, charged particles called **ions** are formed. Ions can be either positively (lost electrons) or negatively (gained electrons) charged.

**Acids** When acids dissolve in water they produce hydrogen ions, $H^+$.

**Alkalis** When bases dissolve in water they produce hydroxide ions, $OH^-$.

**Base** A base is chemically opposite to an acid. Some bases dissolve in water and are called alkalis. But other bases, including many metal oxides, do not dissolve in water.

## Neutralisation Reaction

When the $H^+$ ions from an acid react with the $OH^-$ ions from an alkali, a neutralisation reaction occurs to form water. This is the equation for the reaction:

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ $\quad\quad$ $2HCl + NaOH \rightarrow 2NaCl + H_2O$

For example, hydrochloric acid and sodium hydroxide solutions react together to form water and sodium chloride solution. The acid contains $H^+$ ions and $Cl^-$ ions, and the alkali contains $Na^+$ ions and $OH^-$ ions. The $H^+$ ions and $OH^-$ ions produce the water, and the $Na^+$ ions and $Cl^-$ ions produce the sodium chloride (salt), NaCl(aq).

*One unusual wasp repellent is sliced cucumber! This vegetable has a chemical property which wasps just don't like. Use your purple cabbage to juice to find out what it is!*

## Acids and Alkalis in Nature

Wasp sting venom is alkaline and so its effects can be neutralized with vinegar or another weak acid and this neutralisation then reduces the pain.

Bee sting venom is acidic and so its effects can be neutralized with bicarbonate of soda or another weak base or alkali solution and this reaction also reduces the pain.

Wasps naturally prey on other animals. They feed insects and other arthropods to their young, which develop in the nest. They are beneficial because they prey on caterpillars, flies, crickets and other insects which are considered to be pests.

During late summer and autumn, as queen wasps stop laying eggs and their nests decline, wasps change their food gathering priorities and are more interested in collecting sweets and other carbohydrates. Some wasps may become aggressive scavengers around human food and are commonly found around outdoor activities where food or drinks are served.

Bees feed only on nectar (carbohydrates) and pollen (protein) from flowers. Honey bees sometimes visit rubbish bins and soft-drink containers to feed on sugary foods.

# Experiment 2: The Disappearing and Reappearing Dragon

**What you have:**

- Set of FriXion pens
- Template of Dragon


**What you need:**

- Hairdryer
- A 4 Sheet of Paper
- Small Resealable Bag
- Cup of Crushed Ice
- Cup of Salt
- Thermometer
- Paper Towels
- Tray (bigger than A4) or clipboard
- double sided tape or cellotape

## SAFETY:

- Do not use the hair dryer near liquids.
- Do not let the hair dryer over-heat.
- Un plug the hairdryer when not in use.

The bag containing the ice and salt is not to be held by unprotected hands as the contents are cold enough to cause tissue damage! If you don't have any thermal Gloves or tea towels are needed to protect the hands from the cold.

## Nuts & Bolts

When you rub the dragon drawn with the FriXion pens with the hard rubber eraser, heat from the resulting friction causes the temperature-sensing compound in the ink to activate acid compounds within the ink, thus allowing them to neutralising the alkaline dye. Heating the ink makes it virtually disappear!

**To speed up the disappearing process Scientific Sue gently waved a hair dryer (on the hot setting) behind the image of the dragon to make the dragon disappear.**

**The image can be recovered if the paper is cooled to temperatures below - 10 C. You can put the image in a clear re-sealable plastic bag and put it in the freezer.**

## Secrets for Success

**Prepare your drawing of Puff the Magic Dragon before the show – see template below.**
**Half fill a large resealable bag with ice – remove any melted water before the show.**

### Making Puff disappear

Choose your volunteers 1 and 2.

Volunteer 1 will put on the gloves and will then hold the picture of Puff in front of them so that the whole class can see it – one hand above and one hand below. The hair dryer is warm – the gloves are to make sure hands are not heated.

Volunteer 2 switches the hair dryer on and uses it to blow heated air on to the back of the picture avoiding the gloves.

The image will disappear in a 'puff!' Switch off hairdryer

Volunteer 1 places the page, picture side up, on the tray – and removed the gloves.

Volunteer 2 puts on the gloves and lifts up tray holding it so that the picture is seen.

Volunteer 1 opens up the bag of ice (excess water removed) and pours the salt on top. they then close the bag securely removing as much of the air as they can in the process. Using their gloved hands mix the salt and ice together – then gently rub the ice bag over the image.

The dragon should then reappear.

If you have time take the temperature of the ice before the salt is added and then 10 s after it has been added.

Does the image reappear just using ice?

If you have an aerosol spray for cleaning your white board – try spray that onto the invisible dragon – what happens? what does that tell you about the temperature of the gas leaving canister?

## Science in a Nutshell - Smart Pens – FriXion by Pilot

The secret behind the magic is in Pilot's proprietary thermochromic ink. The ink uses three types of chemical compounds that rely on:

- acid-base and temperature sensitivity:
- special types of dye that change colour upon reaction with acids;
- compounds that act as acids to produce the colour change; and
- compounds that regulate the temperature at which the colour transition will take place.

Thermochromic inks are heat sensitive and become semi-transparent and are mainly used to reveal a printed message hidden underneath the ink when a temperature change occurs. The most common heat reactive ink is used to reveal a message by heating it up, usually by rubbing. This is the ink in the FriXion pens.

The dyes are called leucodyes and they are chemicals that change colour when heat energy makes their molecules shift back and forth between two subtly different structures – known as the leuco (colourless) and the non-leuco (coloured) forms. The leuco and no-leuco forms absorb and reflect light different, so appear very different colours when printed on a material such as paper or cotton

### To heat the ink Scientific Sue used a hair dryer – how else could you heat the image of Puff safely?

### To cool the image of Puff down we need to achieve temperatures below 0 $^{o}$C – hence the need to add salt to the ice.

Pure water freezes, or melts, at 0 $^{o}$C and boils at 100 $^{o}$C. Therefore, between 0 $^{o}$C and 100 $^{o}$C, water exists in the liquid state. Its molecules are provided with enough heat energy and hence kinetic (movement) energy to move around, but not enough energy to break the relatively loose, 'sticky', bonds between them. When you pour liquids into containers you will notice that they all flow and change shape to fit the dimensions of the base of any container you may pour them in to. The shape of a liquid can change; but its volume, at specific temperatures and pressure, always remains the same; you can test this by pouring a liquid into lots of different shaped measuring jugs: tall, thin, wide and short; the volume is always the same.

However, when the temperature is lowered to below 0 $^{o}$C, the molecules cease to move around – they vibrate only - and they form the crystalline structure of ice, in which the molecules are held together by stronger, 'stickier', bonds.

When any substance freezes, the particles within it arrange themselves into an orderly pattern. This arrangement is called a crystal. When table or sea salt (sodium chloride NaCl) is added to water, a saline solution is formed and the forming of this solution interferes with the orderly arrangement of the particles in the crystal. The result of this is an increase in heat energy required

to be removed from the solution before freezing can occur i.e., the solution freezes at a temperature lower than 0 $^{o}$C; **Salt acts as a freezing point depressant.**

**The movement energy of the molecules in a substance is related to the temperature.** If the molecules initially have a lot of kinetic (movement) energy and we then remove heat from the substance, the molecules will then also lose kinetic energy; the less kinetic energy they have the lower is the temperature.

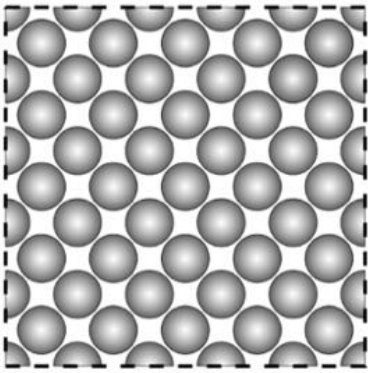
By adding salt to water more heat energy must be removed before the solution can freeze and, furthermore, the more particles of salt added, the more kinetic energy must be removed from the solution before it freezes, in other words: the greater the concentration of the salt (solute) the lower will be the freezing point of the water (solvent).

For a solution of table salt in water, under controlled laboratory conditions, the freezing point of water has been measured at -21 $^{o}$C. In the 'real' world say on pathways, roads and steps leading up to front doors; sodium chloride can melt ice down to -15 $^{o}$C. **This is why gloves must be worn by your volunteer.**

Ice has to absorb heat energy in order to melt, in this demonstration; the heat energy is absorbed from the water, the surrounding air and the hands holding the bag. When you add the salt to the ice, it lowers the freezing point of the water-salt solution. To melt the newly formed ice which is at a temperature now less than 0 $^{o}$C, even more energy has to be absorbed from the environment in order to make it melt. The newly formed ice is now colder than before.

## States of Matter

Solids have the firmest shape of the three states of matter; they do not flow like liquids or spread themselves out like gases. Solids can be physically held, and stay the same shape unless acted on by an outside force. Similarly, solids stay in one place unless moved by an outside force.

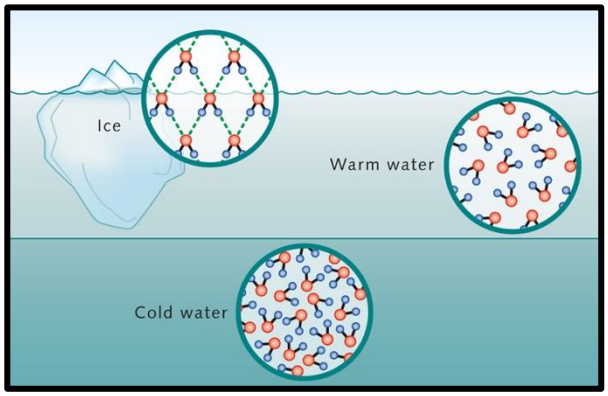


The particles in a solid:

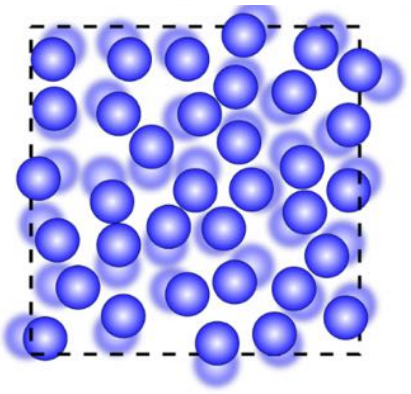
- sit very closely together;
- are in a regular arrangement and in fixed position;
- vibrate about a fixed position but do not move through the solid;
- are held together by strong forces.

This explains why solids have a fixed shape and volume.

On freezing, water molecules rearrange themselves into hollow rings. This is why water expands (thus becomes less dense) when it freezes unlike other liquids which contract – hence solid water (ice) floats!




Liquids have a much looser shape than solids; they can be poured easily and cannot be physically held without a container. Liquids move to fill the shape of the container they are in. If they are not held by a container, they will move as far as gravity will take them.

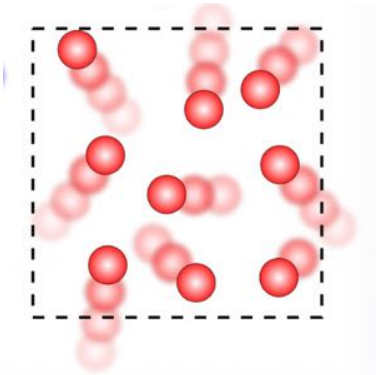


The particles in a liquid:

- sit close together but some gaps have appeared;
- can move past each other because of the gaps;
- have enough energy to prevent the forces between them holding them in a fixed, regular arrangement;
- are randomly arranged.

This explains why liquids have a fixed volume but take on the shape of their container.

Gases have the loosest shape of all the three states of matter, so they are the hardest to contain. Similarly, to liquids, gases spread themselves out to fill whatever space they are in. Whilst gases are affected by gravity, they are not affected in the same ways as liquids or solids. Gases are often invisible.
The particles in a gas:



- are much further apart;
- are entirely free to move because the forces between them are weak;
- are randomly arranged;
- move quickly and randomly in all directions.

.


- ***solids have a fixed shape and volume;***
- ***liquids have a fixed volume but take on the shape of their container;***
- ***gases completely fill their container and have the volume of their container.***

# Puff the Magic Dragon Setting the Scene

Place a thin sheet of paper over the dragon.

Using one of the darker FriXion pens trace the outline of the dragon.

Using the other FriXion pens colour in your dragon.

## Smart Colours

Devi Stuart-Fox, an Australian scientist has, as a result of her studies of the colour in lizards and birds, shown that the remarkable ability of chameleons to change colour evolved not as camouflage, but as a social and territorial display. She has also found out that bearded dragons change colour in response to heat – they are thermochromic. Many of your children will have seen thermochromic mugs, ask them to think about how materials which change colour due to a difference in heat could be used in the home.

As a result of Devi's studies other scientists are now developing bandages, smart bandages, that change colour in response to slight changes in the temperature of the wound.

Scientists have invented colour-changing bowls and spoons which let parents know if the food for babies is too hot plus toys which change colour in the bath indicating the waters' temperature.


Children may also have seen the colour changing thermometers which are placed on the forehead.

Everyone's heard the phrase "red hot," but what does it actually mean? If you heat an iron bar in a furnace, you'll see it slowly changes colour from its original gray-black (at about 600°C) to red hot (~950°C), yellow hot (~1100°C), and then white hot (at higher temperatures still). The hotter it gets; the more energy it contains. As the fire pumps energy into the iron, the irons' atoms become "excited" and unstable, and their electrons absorb the energy briefly, then hurl it back out again in the form of light particles known as photons. That's generally why hot things change colour—and why their colour changes (from red to white) as they get hotter and spew out different kinds of light energy. It's an example of what's called incandescence, where heat energy is constantly converted to light energy.

Thermochromic materials change colour at much lower temperatures and for very different reasons that have nothing to do with incandescence. There are two main types of materials that are widely used to produce thermochromic effects. Some use **liquid crystals** (the materials from which your computer or mobile phone display is most likely made); others use organic (carbon-based) dyes known as **leuco dyes** the dyes used in the FriXion pens.

Sometimes we want things to change colour as they get hotter or colder just for novelty or entertainment.

Or maybe you have a T-shirt or a poster that changes colour when you touch it?

.

# Experiment 3: The Vomiting Dragon

## What you have:

- 500 ml Plastic Bottle
- 7 g Dried Yeast
- 60 ml 6% or 9% Hydrogen Peroxide


## What you need:

- Washing-up Liquid
- 20 ml water (warm)
- small beaker
- Green Food Colouring
- Small Spoon or Stirrer
- Tray
- Paper Towels
- **Safety Glasses**
- Funnel


## SAFETY:

### Hydrogen Peroxide $H_2O_2$

**For external use only.**
When not in use keep away from children.
**Can irritate skin and eyes.**

Not for use in closed cavities or on surgical wounds due to risk of oxygen released into the circulation causing gas embolism.

Product bleaches clothes

**Safety glasses must be worn.**

**Hands must be washed after handling chemicals**

## Nuts and Bolts

Hydrogen peroxide was discovered in 1818 by French chemist Louis Jacques Thernard. The chemical compound of hydrogen peroxide is a weak acid, strong oxidiser, disinfectant, and a bleaching agent. Since it degrades to oxygen and water, it is considered safe for the environment.

3 % hydrogen peroxide is a fantastic sanitiser of children's toys and toothbrushes!

This demonstration is also called 'Elephant's Toothpaste' due to the fact that it looks like toothpaste being continually squeezed out of the tube. Just, be sure the children do not get our foaming result in their mouths!

The tray, or bowl is required as the foam will overflow.

The reaction will continue and foam will be produced until all of the hydrogen peroxide ($H_2O_2$) has been broken down into water ($H_2O$) and oxygen ($O_2$).

**Have fun playing with the foam after the experiment is over! It is safe to touch because all that foam is just soap, water and oxygen. Let your children have some fun with the foam too. Just be sure to have a towel handy! Safety Glasses are to be worn**

**Other Ideas to Try**

- **Compare 3% hydrogen peroxide with 6% hydrogen peroxide**
- **Try adding more or less yeast. How does this affect the amount of foam produced?**
- **Try mixing the yeast with water at different temperatures. How does this affect the amount of foam produced?**
- **Try different shaped and sizes of bottles.**

## Secrets for Success

- Add 8 drops of green food colouring (or the colouring of your choice – who is to say dragon's vomit is green!) into the bottle
- Add a large squirt (15 ml) of washing up liquid into the bottle and swish the bottle around to mixed the 2 liquids.
- Measure out 60 ml of 6 % hydrogen peroxide and with the aid of a funnel add this to the bottle. Clean up any spillages immediately with plenty of water.
- Place the bottle in a clear bowl on or a tray with a deep lip.
- In a small mixing cup combine 20 ml warm water with one sachet (7 g) of yeast and mix for about 30 seconds.
- **Now the fun begins!** Pour the yeast mixture into the bottle (with the aid of the funnel) and watch the foaminess begin.

## Science in a Nutshell

This foam is especially special as each bubble is filled with the gas oxygen.

**Hydrogen peroxide** very slowly decomposes to form **water** and **oxygen**.

$$2\,H_2O_2(aq) \xrightarrow{catalyst} 2\,H_2O(l) + O_2(g)$$

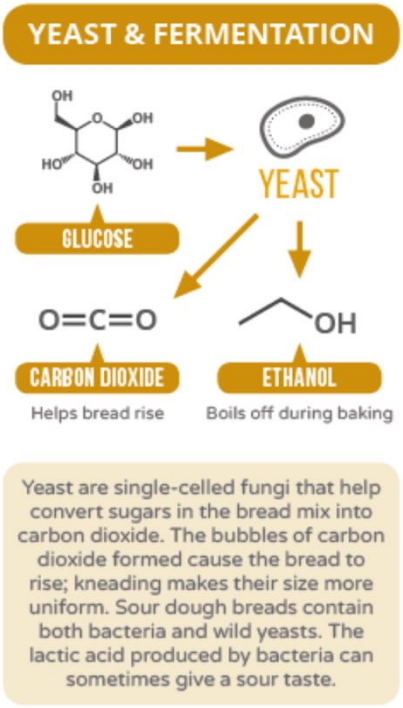
$$\text{hydrogen peroxide} \xrightarrow{catalyst} \text{water} + \text{oxygen}$$

The yeast acted as a **catalyst** (a chemical used to speed up chemical reactions without itself undergoing any changes) to speed up the emission of oxygen from the hydrogen peroxide.

Since it did this rapidly, lots and lots of tiny bubbles were created.

Ask your children to touch the bottle (washing their hands afterwards if they end up bubbly) – they will notice it has warmed up. This is an **exothermic reaction,** which means it not only created foam, it created heat energy too!

The foam produced is just water, soap and oxygen, so you can clean it up with a sponge and pour any extra liquid left in the bottle down the sink.




Hydrogen Peroxide 6% Solution is a mild antiseptic and antifungal agent used on minor cuts, wounds and skin ulcers to prevent infection. When applied to the skin, it releases oxygen and causes effervescence (foams). This helps remove dead skin and cleans the wound making the recovery process faster.

$H_2O_2$ is available in other concentrations – higher concentrations are more dangerous and must be handled carefully. $H_2O_2$ also breaks down when exposed to light, which is why it usually comes in dark brown bottles.

Yeast is an organism that contains a special chemical called catalase that can act as a catalyst to help break down hydrogen peroxide. Catalase is present in almost all living things that are exposed to oxygen, and it helps them break down naturally occurring hydrogen peroxide.

The cool thing about this activity is that the enzyme Catalase can also be found in potatoes, dogs and even us! We have the same enzyme in our bodies. That is why you see the 6 % hydrogen peroxide bubble when you put it on a cut or scrape. The oxygen released is what kills the germs in the cut. We have this enzyme because we naturally produce low amounts hydrogen peroxide as a by-product of oxidative metabolism (the way that a cell gains useful energy). Our cells need energy, but low amounts of hydrogen peroxide are produced and need to be neutralised (broken down) through the action of enzymes such as Catalase.

Hydrogen peroxide reacting with a potato

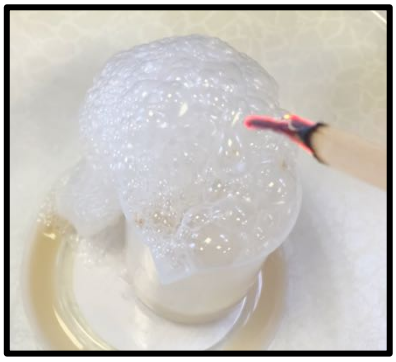
# Experiment 4: The Fire-Starting Dragon

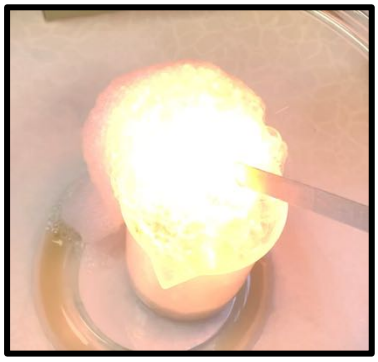
**What you have:**

- 15 ml 6 % Hydrogen Peroxide
- ¼ Teaspoon of Dried Yeast
- Wooden Splint
- Box of Matches
- Candle

**What you need:**

- Clear Beaker
- Bowl or Tray
- Safety Glasses
- Measuring Spoons
- Small Beaker with 15 ml Warm Water





## SAFETY:

### Hydrogen Peroxide $H_2O_2$

**For external use only.**
When not in use keep away from children.
**Can irritate skin and eyes.**

Not for use in closed cavities or on surgical wounds due to risk of oxygen released into the circulation causing gas embolism.

Product bleaches clothes

**Safety glasses must be worn.**

**Hands must be washed after handling chemicals**

When lighting the match strike away from your body. Store matches out of sight and reach from children

When the candle is lit avoid drafts, vents or air currents. Never leave the burning candle unattended.

Change the wooden splint once it has burned to half it's original length.

# Nuts & Bolts

Hydrogen peroxide ($H_2O_2$) seems like a fairly innocuous liquid. It's similar in structure to water ($H_2O$) but with an extra oxygen molecule. And although that molecule may seem like a small difference, it's an important one. The additional oxygen makes it a slightly acidic solution and an oxidising agent.

Oxygen is an invisible molecule that makes up around $1/5^{th}$ of the air that we breathe. The instability of hydrogen peroxide means that the compound can come apart very quickly. The instability of the peroxide combined with yeast creates an exothermic reaction (heat given out). The heat plus the oxygen could result in a fire with the appropriate fuel and conditions. We are using a weak solution of hydrogen peroxide so the amount of heat generated is small, however in the show video you will see Scientific Sue use hydrogen peroxide 5 times stronger than the one you are using!

# Secrets for Success

## Generating Oxygen Gas

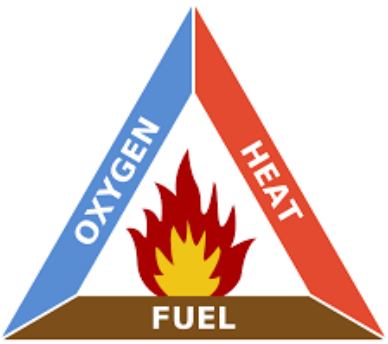
- Add half a sachet of yeast (approx. 3 g) to 10 ml of warm water.
- Stir for 30 seconds.
- Add 30 of hydrogen peroxide 6 % to a clear beaker.

## Testing Oxygen Gas

- Using a match, light the candle
- Using the flame, light the end of the wooden taper.
- Let the taper burn for a few seconds then gently blow the flame out – the end will glow red hot.
- Slowly place the glowing end into the beaker containing the oxygen. Remove as soon as it re-lights.
- Repeat – notice you have to lower the glowing splint a little lower into the beaker.

# Science in a Nutshell

There is a lot of chemistry behind the simple lighting of a flame. In this experiment we are going to relight a fire using an invisible gas called oxygen.




**Meet the fire triangle!**

The fire triangle, or combustion triangle, is composed of the three ingredients needed to ignite and sustain a fire: Heat, Fuel and Oxygen.

If just one of these components is removed, the fire triangle will collapse and the fire will be extinguished.

## Let's explore these components in more detail:

**1. Heat**
A source of heat is required in order for ignition to occur, and different materials have different 'flash points' e.g., the lowest temperature at which they ignite.

Unfortunately, combustion reactions also produce heat as they burn, further increasing the temperature of the fuel. For some types of fire, the heat can be **cooled** with the application of **water**.

**2. Fuel**
A fire cannot begin if there is no material to burn. Homes, schools and businesses are full of flammable materials, such as paper, oil, wood and fabrics. Any of these can serve as a fuel for a fire.

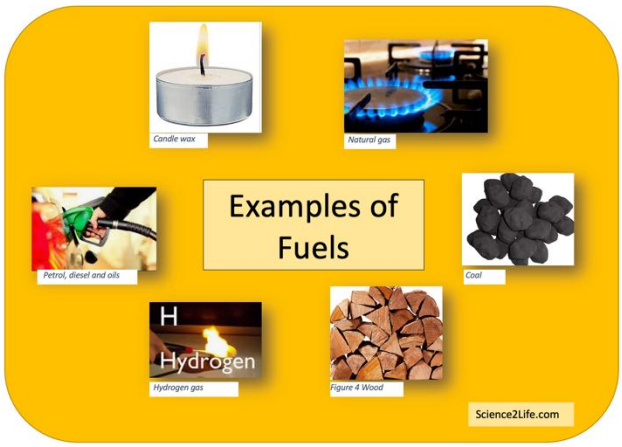
Some materials burn more easily than others. Fuels are probably the most difficult 'side' of the fire triangle to remove, so it's wise to store them appropriately to prevent them becoming a fire hazard.

**3. Oxygen**
To sustain the combustion reaction, oxygen (or an oxidising agent) is needed, as it reacts with the burning fuel to release heat and $CO_2$. Earth's atmosphere consists of 21% oxygen, so there is plenty available to trigger a fire if the other two components are present.

Fire blankets and certain fire extinguishers containing carbon dioxide remove the oxygen 'side' of the triangle by removing it or displacing it, causing suffocation and thereby ceasing the combustion reaction.

**Fire Triangle Facts**

- Normal air contains 21% oxygen.
- Fuel may also contain oxygen
- Heat sources include: the Sun, hot surfaces, sparks, friction and electrical energy.
- Fuel sources can be a solid, liquid or gas.



# Experiment 5: The Fire-Fighting Dragon

**What you have:**

- Citric Acid
- Baking Soda
- Candle
- Matches
- 500 ml Bottle
- Balloon


**What you need:**

- 100 ml Vinegar – optional
- Clear glass beaker to place the candle into – optional
- 100 ml Water if using citric acid
- Funnel
- Safety Glasses

## SAFETY:

**Safety glasses must be worn.**

**Hands must be washed after handling chemicals**

When lighting the match strike away from your body. Store matches out of sight and reach from children

When the candle is lit avoid drafts, vents or air currents. Never leave the burning candle unattended.

Change the wooden splint once it has burned to half it's original length.

## Nuts & Bolts

- Baking soda – Chemical name sodium hydrogen carbonate (bicarbonate of soda) with formula
- $NaHCO_3$
- Citric acid with formula $C_6H_8O_7$
- Vinegar – a dilute solution of ethanoic acid in water with the formula $CH_3COOH$

### Disposal.

Although all reactants are household chemicals and foodstuffs, caution should be taken not to get splashes in the eyes and clothes should be protected. The products of the reaction are relatively safe and can be disposed of by washing down the sink with plenty of water.

## Secrets for Success

- Add 1 tablespoon of citric acid and 2 tablespoonfuls of baking soda to the bottle (with the aid of a dry funnel) or jug.

- Slowly add 100 ml of water to the bottle or jug – it has to be slow because the reaction is fast and we will lose the carbon dioxide gas the bubbles will just overflow out of the bottle – In the show Sue mixes the chemicals quickly – however the baking soda starts off in a balloon. the balloon is placed over the neck of the bottle and when the chemicals are mixed the balloon traps all of the carbon dioxide gas and prevents any from leaving the bottle.
- Light the candle.
- Pour the carbon dioxide carefully from the bottle or jug over the candle. Pour it as though it were water – stop pouring when the actual liquid in the bottle is about to leave!

Because carbon dioxide is heavier that air, it will pour out of the vessel and over the candle and extinguish the flame.

If there are still some undissolved crystals at the bottom of the vessel add some more water.

If you are using vinegar instead of citric acid use 100 ml of vinegar to 1 tablespoon of baking soda. Be sure not to pour any of the vinegar out of the bottle when extinguishing the flame.

Add another spoonful of baking soda to the bottle and/ or vinegar to create more $CO_2$ gas.

Don't mix the ingredients too quickly or the fizzing mixture could overflow out of the vessel taking your carbon dioxide gas with it!

When the vinegar (ethanoic acid) or citric acid is mixed with the baking soda (sodium hydrogen carbonate) a chemical reaction takes place. Lots of carbon dioxide bubbles are formed in a very short period of time.


This experiment is an example of a reaction between an acid and a base. Such reactions typically form a "salt" and water.

ACID + BASE → SALT + WATER

Because the acid component in this experiment is ethanoic acid, it allows the production of one of the products to be sodium ethanoate. That is the stuff referred

to as the "salt." In this experiment, the base has a carbonate component; hence carbon dioxide is also formed.

Carbon dioxide in the liquid form is found in many fire extinguishers. For it to be liquid it is kept at certain pressures and temperatures, an extinguisher can only be used once for this reason. When released the liquid $CO_2$ quickly changes into a gas. This gas is heavier than air and sinks downwards. If aimed correctly the gas forms a blanket covering over the fire – blocking out the oxygen required for combustion. The fire is extinguished.

## SHOW CHECKLIST

| **Before the Virtual Experience** | | CHECK |
|---|---|---|
| **Prepare the performance space** | Set a small table beside the screen on which you will be watching the show – the volunteers need to see the screen and the children in the class need to see both the screen and the volunteers. | |
| | Hair dryer | |
| | Extension lead – this is only required if the socket for the hair dryer is not close to the performance area | |
| | Safety glasses – these can be proper safety glasses or a visor, swimming goggles, reading glasses – anything that protects the eyes from splashes | |
| | Paper towels | |
| | Bucket of warm water for washing hands – if you don't have a sink in the room. | |
| | 5 trays **– Trays 1, 3 & 4 will be used to catch spillages** | |
| | Sachet of dried red cabbage | √ |
| | Add a teaspoon of dried red cabbage to 100 ml warm water. This will be your **Dragon's Drool.** If you don't want the rehydrated cabbage bits pass the liquid through a sieve. | |
| For tray 1 | Pour about 20 ml of dragon's drool into 2 small medicine cups or beakers | |
| For tray 2 | Print page 17 – Puff the Magic Dragon. | |
| | Pack of FriXion Pens | √ |
| | A 4 Page<br>Place the blank page over the printed page. Using the black FriXion pen trace the outline of the dragon. Using the other colours colour in your dragon | |
| | Clip board or tray | |
| | Double sided tape or sellotape<br>Use this to secure the dragon page on to board/tray | |

## SHOW CHECKLIST

| | | |
|---|---|---|
| For tray 3 | Pour 60 ml of Hydrogen peroxide into a small jug | |
| For tray 3 | Add food colouring or paint to the 500 ml bottle | |
| For tray 4 | Pour 15 ml of hydrogen peroxide into a plastic shot glass or medicine cup | |
| For tray 5 | Collect a 2nd 500 ml bottle<br>*Required if you don't want to wash out the bottle used in experiment 3 during the show* | |
| **TRAY 1: Moody Dragon** | Pour about 20 ml of the cabbage juice into 2 small clear cups – a medicine cup is perfect | |
| | Bag of citric acid | √ |
| | Tub of baking soda | √ |
| | 2 clear beakers (200-300 ml) | |
| | 2 table spoons | |
| | 2 beakers each containing 100 ml of water | |
| | 2 pairs of safety glasses | |
| | | |
| **TRAY 2: Disappearing Dragon** | Hairdryer | |
| | FriXion Pens | √ |
| | Coloured in image of dragon secured to a hard backing | |
| | Ice box with a sealed bag of ice cubes inside | |
| | Cup of table salt | |
| | Gloves<br>To protect hands from hot hair dryer and cold ice | |
| | Thermometer - optional | |
| | | |
| **TRAY 3: Vomiting Dragon** | 500 ml plastic bottle with food colouring or paint already inside. | √ |
| | 7 g yeast<br>1 sachet or 1 heaped teaspoonful | √ |

## SHOW CHECKLIST

| | | |
|---|---|---|
| | Bottle of 6% or 9% hydrogen peroxide | √ |
| | Pour 60 ml of Hydrogen peroxide into a small jug | √ |
| | Washing up liquid | |
| | Small beaker with 20 ml warm water | |
| | Small spoon | |
| | Funnel | |
| | Paper towels | |
| | Safety glasses | |
| | | |
| **TRAY 4: Fire-Starting Dragon** | 15 ml of hydrogen peroxide 6% or 9% in small beaker | √ |
| | Small teaspoon | |
| | Dried yeast | √ |
| | Box of Matches | √ |
| | Tea Light Candle | √ |
| | Small beaker (50 – 200 ml) containing 15 ml warm water | |
| | Safety Glasses | |
| | | |
| **TRAY 5: Fire-Fighting Dragon** | 500 ml plastic bottle | |
| | Bottle of white vinegar | |
| | Candle | |
| | Matches | |
| | Funnel | |
| | 2 balloons | |

## SHOW CHECKLIST

| | | |
|---|---|---|
| | Baking Soda | √ |
| | *Citric Acid + 100 ml water*<br>*If you are not using vinegar* | √ |
| | Safety Glasses | |
| | | |

# The How to Train Your Dragon to Balance and then Spin Workshop

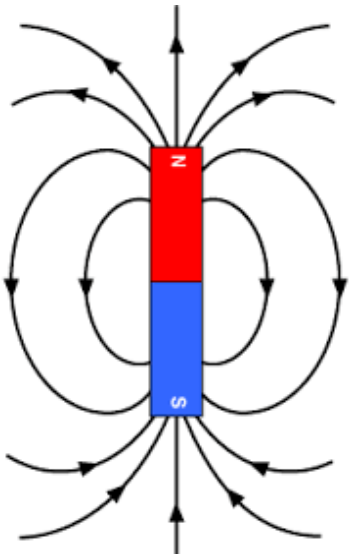
## Aim of the Activity

1. With the aid of the template make a cardboard Dragon and balance it on its nose!
2. Once balanced train your dragon to spin using magnet.

The dragon can be balanced on a pencil tip or wooden kebab stick.

The balancing dragons are for the children to keep. The magnets stay with you.
Wrap your magnets in cling film before you store them away.

## Hazards of Ferrite Magnets




Magnets are incredibly useful and fun, but they aren't without hazards. Please read below before allowing the children to handle magnets – safety first!

**Danger of Breaking or Chipping**
The children will have the magnets on the table. They must be aware that if they place their magnet close to another, they will attract each other and jump together. This is the most common cause of broken magnets and it is possible that one or both magnets could chip or shatter. The second being magnets falling from a table on to a hard floor.

Due to the force exerted by the magnets it is possible that chips may fly at high speed into someone's eye, therefore we advise that when handling more than one ferrite magnet children should wear eye protection.

**Magnetically Sensitive Items**
Keep the magnets at least 20 cm away from objects that can be damaged by magnetism. Items such as mechanical watches, pacemakers, credit cards and other magnetically stored media.

## Nuts & Bolts

- Dragon template – 350g card
- Colouring and art materials
- Scissors
- Adhesive magnetic dots
- Paperclips - metallic

- Ferrite Magnet
- Pencil or Wooden Kebab Stick
- Plasticine or Blu-Tac

## Secrets for Success

1. Cut out the Dragon – it can be coloured in and decorated.
2. Try to balance the dragon on the tip of your finger. Does it stay? *No*
3. Where does it balance? This point is called its centre of mass. *The chest area*
4. For our dragon to balance on its nose its natural balance point has to move from the chest area to its nose – and to do this, weights need to be added to the front tips of its wings.
5. Weights can be paperclips (supplied), pennies or plasticine
6. The size of the weights will depend on the thickness of the card that you use. If you are using the template on page 33 you can print it onto paper and then glue it onto card such as a cereal box, the number of paperclips required will vary.
7. What would happen to the centre of mass if you were to enlarge or reduce the size of dragon?
8. Once you have trained your dragon to balance can you use the magnet to get it to spin? Are the metallic paperclips pulled towards or pushed away from the magnet?
9. Can it be trained to spin if pennies or plasticine are used? *No for plasticine but yes to coins which contain nickel – all new coins should be attracted to magnets – older coins will not.*
10. The 2 small adhesive dot magnets are to be stuck on the underside of your dragon on the wing tips. When the children are not playing with their dragon it can be allowed to rest on the fridge door or any other magnetic surface.

## Science in a Nutshell

All objects have a balancing point, called the **centre of gravity**. The lower you make the centre of gravity the more stable the object is.

The centre of gravity is also often called the **centre of mass.**

This balancing dragon is a toy that has its centre of gravity located at the tip of its nose. The centre of gravity is a special point on an object. It's the point at which the weight of the body Is perfectly balanced.

To engineer it so that the centre of gravity is at the tip of the nose, the wings have been designed to extend in front of the nose far enough, and made heavy enough (with the addition of the paper clips or other masses), to balance the weight of the dragon at its nose.

In most objects it is not clear where the centre of gravity is. If an object has a strange shape, then you cannot know by looking at it where the centre of gravity is.

If an object has a uniform shape, like a pencil, or a square, then the centre of gravity is easy to determine. It's in the centre of the object. But for objects with non-uniform shapes this is not known ahead of time. To find the centre of gravity for these objects you need to use trial and error.

You must try balancing the object on different points until you find where the object is perfectly balanced, and doesn't fall over.

**This point, once found, is the centre of gravity.**

Mass is the amount of matter in an object. Mass is measured in kilograms (kg).

Weight is a force due to the pull of gravity on an object's mass. Weight is measured in Newtons (N).

**Magnets** are objects that have a magnetic field (an invisible pattern of magnetism). A magnet will attract materials which contain iron, cobalt or nickel in them. Allow the children to play with a magnet. Which items in the room are attracted to magnets?

Each magnet has a north and south pole. Have the children work in pairs, each holding one magnet. They will find out (and feel) that south poles are pulled towards north poles - **OPPOSITES ATTRACT**
They will also find out that north pole of one magnet will repel (push away) the north pole of the other and the south pole of a magnet repels the south pole of another magnet – **LIKE POLES REPEL**

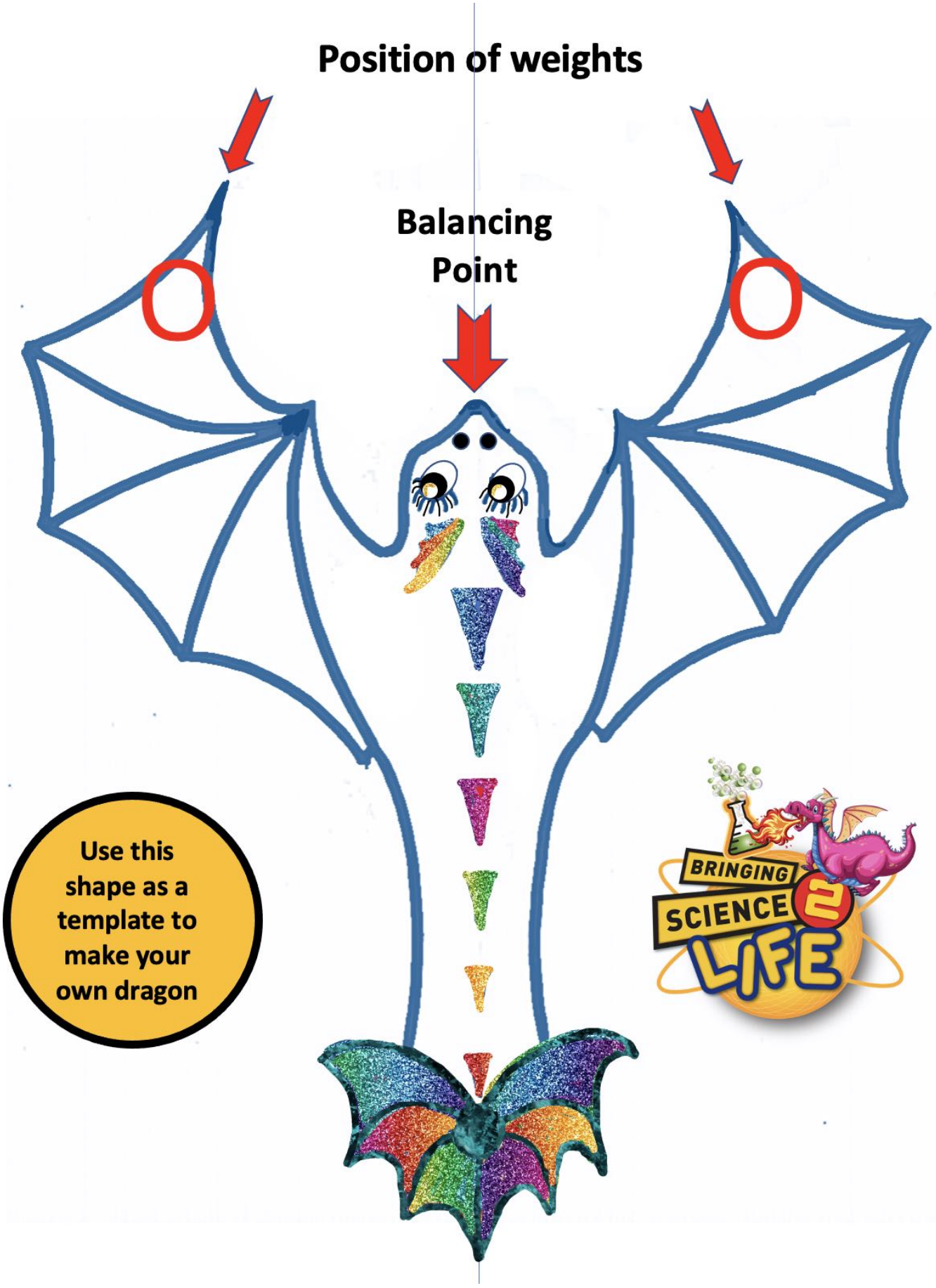
## Using the ferrite magnet, the children can make their balancing dragon spin.

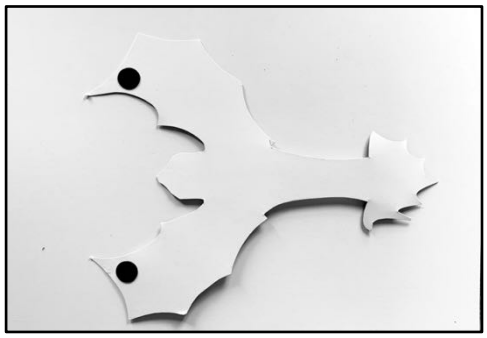
Push the pencil or Wooden kebab stick into some plasticine or blu-tac so that it is upright.

Balance the Dragon.

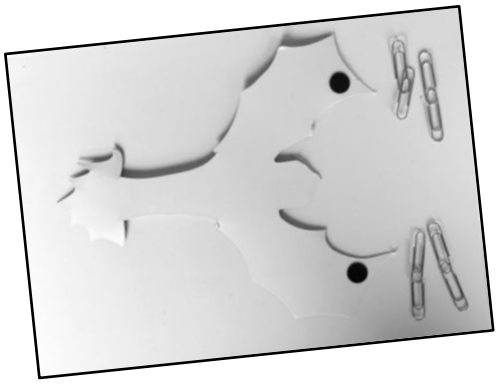
By carefully (slowly) bringing the magnet close to the paperclips the dragon will start to spin. The paperclips (or coins) will be pulled towards the magnet. Care must be taken to make sure the magnet is brought too close to the dragon otherwise the paper clips will stick to the magnet and the dragon will fall.

What metal is in the paperclips which allows them to be attracted to the magnet? *Iron*
What metal is in the coins which allows them to be attracted to the magnet? *Nickel*

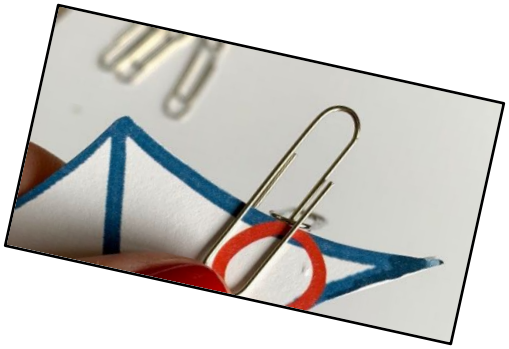

Position of weights
Balancing Point
Use this shape as a template to make your own dragon
BRINGING SCIENCE 2 LIFE



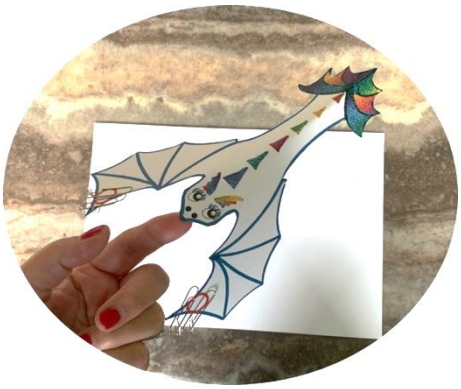
1 Attach the dot magnets to the underside of the wing tips



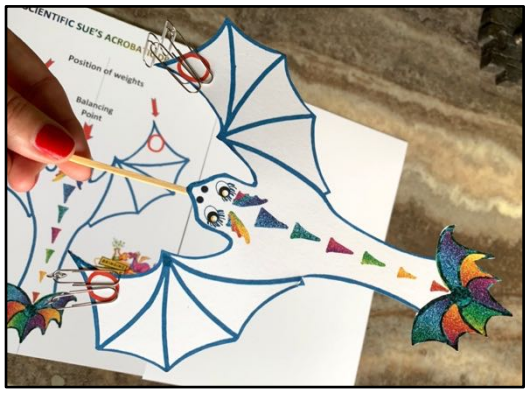
2 Gather 8 paperclips join them together so that you have 4 sets of 2



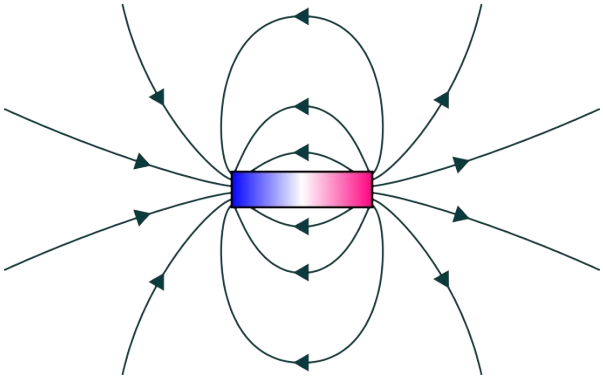
3 Attach the paperclips to the wing tips as shown – 1 set to each wing



4 Test – does your dragon balance on its nose? No – add more paperclips.




5 Once your dragon balances on your finger tip find other items it will balance on.



6 Once balanced – lift up your ferrite magnet and slowly bring it close to one of the wing tips. What happens?

## Did you manage to train your dragon to spin?

**When not is use let your dragon have a wee snooze. Attach it to the fridge door so that everyone can see how beautiful it is!**

# Science2lIfe's Virtual Experience Plus!

## *The next best thing to a live show!*


***Enthusiastic, informative and interactive science shows delivered virtually – with pupil interactions built in!***

**Innovative Covid Friendly Learning**

***Make savings in cost and time:***
***You don't have to drive children to a theatre, savings on bus and coach fees.***
***You choose 'the how' and 'the when' the programmes are delivered.***

***Science Education in a Fun Format***

***Flexible Learning***


The most exciting part of our virtually led outreach experiences is the fact that you the teacher (facilitator) is now in charge of the speed at which the show and workshop takes place. You can stop and start the show video to check on student's understanding or to carry out one of the experiments.

There is no set timetable to adhere to; this means the show and workshop can be delivered together, one after the other, or on two separate days.


**The science show experience is interactive!**
**The workshops are hands-on!**

There are multiple opportunities for the pupils to engage throughout the show… **yes volunteers are still required!**

| Science Show | | Virtual Experience Plus! | Need extra STEAM kits? * | |
|---|---|---|---|---|
| | | | Show | Workshop |
| | | Including the personalisation of the show plus postage | | For 30 students |
| 1 | Science of Bubbles | €250 | €15 | €55 |
| 2 | Science of Dragons | €250 | €25 | €30 |
| 3 | Supermarket Science | €250 | €15 | €25 |

* You may not want to share the show box (!) or you may want to treat the children and deliver the workshop as a make and take activity. The extra STEAM kit prices do not include postage. Want to add more on first order – contact us for a quote.

## The Nuts and Bolts


When you book your Virtual Science Experience you will be

1- sent your video of choice (which has an introduction section tailored to your event). This can then be up-loaded onto your schools' platform.
2- sent a second video and pdf document at the same time – they give guidance on the interactive sections of the show (the parts Scientific Sue needs volunteers for) and on the workshop.
3- posted the Experience Box. This box contains the items and chemicals required for the interactive sections of the show and the subsequent hands-on workshop.

Scientific Sue would normally choose just one or two volunteers per sketch to help her out on stage; with the shows now being virtual you, the teacher (facilitator), is now in charge of these sections of the activity. You will be guided to stop the video at certain points throughout the show. At these times:

1. You may stick to the programme and choose the number of volunteers Sue requests or
2. You can pause the video for longer and have extra helpers or

3. let ALL of your pupils do the experiment!

We love option 3! It is perfect for the classroom plus festivals, birthday parties and fun corporate events – This is the joy of not being constrained by a timetable built around an outreach programme which is not virtual.

## *Why do we still want our programmes to be interactive*?

- The advantages of interactivity to the children are great. They receive an enhanced, more participatory experience and you can tailor the delivery of the show and workshop to meet the demands of your timetable and student's educatory needs.
- The children are emotionally invested in the learning.
- Interactive involvement throughout the show promotes autonomous learning within your children.

## We add the personal touch to your show video of choice!

Let us know about your event and the key messages you want your audience to be aware of. Scientific Sue will produce a short introduction video for you which will then be spliced into the video/s or your choice. Want your own introduction added? Just send us the clip via WeTransfer.

Your logo (plus other logos if the event is sponsored) will also be included.

Each 'Virtual Experience Plus!' activity comes with its own set of teaching notes and a short explanatory video for you the teacher (facilitator) on examples of how you can run the sessions as well as the virtual show video and accompanying interactivity box.

## We currently have 3 Virtual Experience PLUS! on offer!

**Want to know more? Contact us scientificsue@science2life.com**

1. **The Science of Bubbles Show and the Bouncing Bubbles Investigation**
2. **The Science of Dragons Show and the Train your Dragon to Balance Activity**
3. **The Supermarket Science Show and the Colour Changing Bath Bomb Activity**


We really hoped you enjoyed the show and workshop experience and would love to hear your feedback! Scientificsue@science2life.com

Please also share your experiences with us we would love to see you and your children in action:

@scientificsue

#science2life

This is a new experience for us too and we are sure there are ways the experiences could be improved upon - and we will only know how to do this if you guide us.