STEAM

SCIENCE-TECHNOLOGY-ENGINEERING-ART-MATHEMATICS

ACADEMY

A VIRTUAL SCIENCE2LIFE EXPERIENCE

SME news
Northern Irish Enterprise Awards 2023
Science2Life
Most Innovative Children's Science Workshop Provider Northern Ireland

Science of Dragons

An interactive event designed by Science2Life to encourage children to:

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

An innovative, Friendly Learning Experience

Science Education in a Fun Format

Flexible Learning

The Science Show is Interactive!!!

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

Dear Teacher,

🐉 *Science of Dragons – A Virtual Science Experience*

Welcome to an exciting, hands-on science adventure for your class — with you in full control of the journey!

When you purchase the **Science of Dragons Virtual Experience**, you'll receive:

✅ A **hands-on kit box** with enough materials for up to **30 pupils**
✅ A **link to the show video** (hosted on YouTube), which pupils can interact with
✅ A **teacher guidance video** to help you prepare and lead each activity

These resources will be sent directly once your order has been processed.

FANTASTIC VALUE FOR MONEY!

For just £185 | €220 (including postage!) you get the full virtual experience: The activity box, an engaging show, teacher guidance video, detailed notes, and a personalised 20-second intro for your class!

🧪 A Flexible, Interactive Learning Experience with **no set timetable**, this experience is designed to fit around your schedule. You can:

- Stop, start, or replay the video to reinforce learning
- Use volunteers — or involve the whole class in every activity
- Run the show in one session or spread it out over several days
- Present it to one class, a larger group in the hall, or even share it with families

📦 Ordering Extra Kits?

Your kit includes enough materials for a class of 30.
If you'd like kits for additional classes or group sizes, please contact Sue for a personalised quote:

📧 scientificsue@science2life.com
📱 +44 7970 884728

Or visit our **online store** to browse extra kits and refills:
🌐 https://www.science2life.com/store/

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🔥 Fuel Curiosity, Spark Imagination

Every **Science2Life STEAM Academy** show is designed to spark your pupils' curiosity, boost confidence, and bring scientific concepts to life — with dragons, fire, fizz, and fun!

There's **no expiry** on your video access — use it when it suits you.

💥 **Fantastic value. Flexible delivery. Unforgettable learning.**
Thank you for bringing a little science magic into your classroom!

✨ A Bit About Sue – aka *Scientific Sue*

Sue Carvell (aka *Scientific Sue*) is on a mission to make science exciting, accessible, and unforgettable! Her journey began in 1991 as a Physics and Chemistry teacher, but it wasn't long before her passion for hands-on learning led her beyond the classroom.

After completing her Master's in Educational Studies, Sue became one of the founding managers of **W5** (WhoWhatWhereWhenWhy) — the award-winning interactive science centre in Belfast. As W5's Education Programme Director, she created dynamic learning experiences for audiences of all ages, from curious primary pupils to inquisitive adults.

During her time at W5, Sue also served on the **editorial board of *Physics Education***, the official journal of the Institute of Physics. Her contributions to STEM outreach and education earned her a prestigious **Fellowship of the Institute of Physics**.

In 2006, Sue launched her own company, **Science2Life**, bringing interactive STEAM shows, workshops, and teacher training sessions to schools, theatres, and festivals across Ireland and beyond.

From **classrooms in Ireland and the UK** to **stages in Switzerland, Nigeria, Saudi Arabia, Lebanon, the UAE**, and **Qatar**, Sue's engaging performances have sparked scientific curiosity in tens of thousands of learners.

In 2015, Sue made history by leading **1,339 students** in a single lesson — setting a **Guinness World Record** for the *Largest Practical Science Lesson* in partnership with the Northern Ireland Science Festival and the Royal Society of Chemistry.

Today, **Science2Life** also delivers **virtual STEAM shows and workshops** through the *Scientific Sue STEAM Academy*. These programmes are perfect for remote learning and come with downloadable teaching packs, making them easy to integrate into any classroom setting.

💬 *"We know that virtual learning is new for many of us — your feedback is essential! Please let us know what works well and what we can improve so we can continue creating science experiences that excite and inspire."*

📞 **Have a question? Get in touch with Sue directly:**
✉️ **Email:** scientificsue@science2life.com
📱 **Mobile:** +44 7970 884728

🐉 A Bit About the Show

The Science of Dragons show is inspired by Cressida Cowell's much-loved *How to Train Your Dragon* book series — and the thrilling DreamWorks films they inspired. While Cressida never mentions science or engineering explicitly, her world is packed with inventive problem-solving, mechanical creativity, and bold experimentation — all rich in STEM potential.

In every format of *The Science of Dragons Show*, Scientific Sue reveals that Cressida Cowell isn't just a brilliant storyteller — she's a **hidden scientist** in disguise!

This **virtual, interactive show** includes **six hands-on science activities**, with opportunities for pupils to become volunteers and join in the experiments.

📚 Science Meets Literacy

One of the show's core aims is to spark a love of reading alongside scientific curiosity. While many children will be familiar with the *How to Train Your Dragon* films or TV series, far fewer will have read the books.

This activity is an exciting gateway into reading for pleasure — a vital skill linked not just to improved literacy but to long-term academic success across all subjects.
📖 Studies have shown that children who read for enjoyment make **significantly more progress in vocabulary, spelling, and even maths** compared to those who don't (Sullivan & Brown, 2013).

🔬 Unleashing Dragon Science: A Six-Part Adventure

The show is divided into six standalone sections. You can experience them all in one session or spread them across multiple lessons to suit your timetable.

1. **Toothless Flies Again** – Spin, dodge, and defend: investigate forces and motion.
2. **Stormfly's Spectrum** – Explore colour and camouflage through light and reflection.
3. **Science Showdown** – Neutralise the acidic spit of a Changewing in a dramatic reaction!
4. **Unmask the Gas** – Discover a brand-new dragon fire type using gas tests.
5. **Blast Off!** – Train Meatlug to hit the target with a chemical-powered launch.
6. **Balance & Spin** – Engineer and test dragon-spinners to master balance and movement.

🧪 Teacher Tips

Before leading the experience with your class, it's **strongly recommended** that you:

✔ Watch the **Teacher Guidance Video**
✔ Watch the **Show Video** yourself in advance
✔ Make note of any questions — and email Sue with plenty of time to get a reply!

Every activity in the show supports the development of **science process skills** such as prediction, testing, observation, and evaluation. You can easily extend each section into longer investigations or fair test experiments, giving your pupils the chance to think like real scientists — and dragon trainers!

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 Box

Item	Quantity	Item	Quantity
Dried Red Cabbage	15 g	Dragon Templates	31
pH Colour Card	1	Dragon Mask Template	1
Citric Acid	125 g	Marker Pen	1
Baking Soda	125 g	Metallic Paper Clips	30
Linking Balloons	10	Tube of Effervescent tablets with Spring Lid	1
Small Candle	1		

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

Sparks of imagination are at the heart of creativity!

SHOW CHECKLIST: WHAT YOU HAVE (√) – WHAT YOU NEED

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 – if you are not going to hold it – follow the instructions in the teacher video and tape it to the edge of the table.	
	Extension lead – this is only required if the socket for the hair dryer's lead is not long enough.	
	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.	
	6 trays and a spillage tray	
	Sachet of dried red cabbage – this could be done in front of the children during the show	√
	Add **1 teaspoon of dried red cabbage** to **500 ml of warm water** and give it a good stir. This magical purple liquid will become your **Dragon's Drool**! If you'd prefer a smoother potion (without the cabbage bits), simply pour the liquid through a **sieve or fine strainer**.	
TRAY 1: Toothless Flies Again	Take 5 linking balloons from the pack of 10. Inflate them, tying each one securely. Use the linking ends to **connect the balloons into a circle**, forming a loop or ring.	√
	Marker pen	√
	Dragon face template	√
	Draw a face of a dragon on one of the balloons using the marker pen and template for guidance	
	A hairdryer (2400 W)	
	An extension lead	
	Gaffa tape – if you choose not to hold the hairdryer	
	Selection of items to throw at the dancing loop of balloons: bean bags, small balls, plastic bow and arrow (with suckers)	

TRAY 2: Stormfly's Spectrum	Red Cabbage Powder – 10g + pH colour card	√
	Citric acid – 125 g	√
	Baking soda – 125 g	√
	500 ml of warm water	
	2 Small clear beakers (200-300 ml)	
	1 Large clear beaker (500-1000 ml)	
	2 Spoons	
	1 teaspoonful of cabbage powder added to 500 ml of warm water in a clear beaker or jug (500 – 1000 ml)	
	2 x Safety glasses	
	1 Spoonful of citric acid pre-measured into a small pot	
	2 Spoonful's of baking soda pre-measured into a small pot	
TRAY 3: Science Showdown	The larger beaker/jug with 1cm depth of cabbage juice – left over from Activity 2	
	Beaker containing the citric acid – RED solution	
	Beaker containing the baking soda – BLUE solution	
	If your **drip tray has high sides**, place a small inverted bowl, tub, or block **inside the tray** to elevate the larger beaker. This ensures **everyone in the class can see the reaction inside** the beaker clearly.	
	Safety glasses	
TRAY 4: Unmask the Gas	Citric acid	√
	Baking soda	√
	Tea light candle	√
	500 ml Bottle	
	Matches or a lighter	
	Small clear beaker for candle	

	Funnel	
	2 Spoons	
	Balloon	
	100 ml warm water	
	Safety glasses	
	Long tongs or Peg secured to a stick (I use a litter picker in the show)	
TRAY 5: Blast Off!	Tube with spring lid	√
	Citric acid	√
	Baking soda	√
	Jug or bottle of water	
	Tube of effervescent tablets e.g., Vitamin C tablets	
	Bin or box (target	
	Many families use effervescent vitamin tablets at home. Ask pupils to bring in the **empty tubes** — they can be reused for future class experiments. Plus, **the spare lids** are especially useful for this activity!	
TRAY 6: Balancing Dragon	31 x Templates of the balancing dragon	√
	Marker pen	√
	30 x paper clips	√
	Scissors	
	Sellotape	
	Colouring and art materials	
	Pencil or kebab stick (I have my kebab stick stuck in a tub of playdough)	
	2 x coins of the same denomination (children to supply) OR (if you have enough) each child would need 12 paperclips – 6 for each wing.	

Activity 1: Toothless Flies Again!

Spin, Dodge and Defend

What you have:

- 10 Linking Balloons
- Marker Pen
- Dragon Face Template

What you need:

- Hair Dryer 2400W
- Extension Lead
- Gaffa tape (optional)
- Bean bags, balls etc

SAFETY:

Ensure the hairdryer is set to the **cool** setting to avoid blowing hot air toward the children or yourself during the demonstration. This will keep the activity safe and comfortable for everyone involved.

Nuts & Bolts

Inflate five balloons and tie them together as shown in the guidance video. Use a marker to draw a dragon face on one of the balloons—feel free to follow the template or create your own design! If there's no power socket near your demonstration area, make sure to have an extension lead handy.

Secrets for Success

Note: Any round balloons will work – just connect them using double-sided sticky tabs. If the balloons are small, you can connect more together.

Your students will watch you bring this dragon balloon loop to life! With the help of a hairdryer, you'll create airflow across one side of the dragon's curved surface. This faster airflow on this side lowers the pressure, while the slower-moving air on the opposite side increases pressure, causing the dragon to hover and spin in the air.

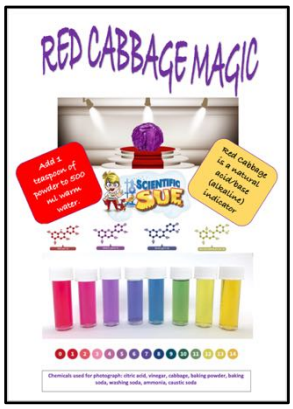
You then ask a brave young Viking volunteer to step up to capture the dragon, throwing various objects you have gathered together to try to knock it out of the sky! This live demonstration will have your students captivated by the sight of a floating, spinning dragon they can interact with in real time.

Activity 2: Stormfly's Spectrum

The Science Behind Colour and Camouflage

What you have:

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



What you need:

- 500 ml Warm Water
- 500 ml Jug
- 2 Clear Beakers
- 2 Stirrers
- 2 small sauce pots (optional)
- 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.

Nuts & Bolts

Divide most of the 500 ml of cabbage juice between two smaller beakers, leaving about 1 cm of juice in the larger beaker – this will be used in Activity 3.

Adding citric acid to the purple juice will turn it red—what mood might this colour represent?

When baking soda is added to the cabbage juice, it turns blue—what mood might this colour represent?

Secrets for Success

For fresh cabbage:

- Chop up the red cabbage, place it in a saucepan
- Add enough water to 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
Or this link 75g

Science in a Nutshell

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**.

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.

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.

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.

Activity 3: Science Showdown

Neutralising a Changewing's Acidic Spit

What you have:

- Dried Cabbage Power 15 g
- pH Colour Card
- Baking Soda 125g
- Citric Acid 125g

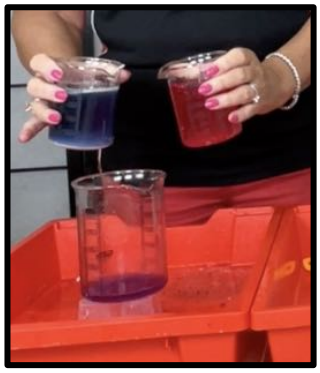
What you need:

- 500 ml Jug/Beaker with a small amount of cabbage juice from Activity 2
- 2 smaller Jugs/Beakers from Activity-2
- Safety Glasses
- Splash tray
- 2 spoons

SAFETY:

Safety glasses are to be worn to prevent any splashes in the eyes.

Hands must be washed after handling chemicals



🔧 Nuts & Bolts – The Neutralisation Splash!

Set the Scene:
Place your **500 ml beaker** (filled with a small amount of purple cabbage juice from Activity 2) in the centre of a **splash tray**.

To make sure everyone can see the magic, **raise the beaker** by placing it on top of an upside-down cup or another beaker.

🟣 The **purple colour** means the solution is **neutral** — with a pH of around **7**.

Time to Call Your Viking Volunteer!
Hand them the **two beakers** from the earlier activity:

- 🟥 One with the **red acidic** solution
- 🟦 One with the **blue alkaline** solution

Ask them to **slowly pour both liquids** into the raised cabbage juice beaker...

🎨 Watch in awe as the colours swirl and mix — turning back to **purple**! This magical colour shift shows that an **acid** and a **base** have cancelled each other out — a perfect **neutralisation**.

But hold on — here comes the best bit...

💥 The reaction releases **carbon dioxide gas**, which creates loads of **fizzing and bubbling** — the mixture will foam up and **overflow** the beaker!

Prepare for giggles, gasps, and a little glorious mess — all in the name of science! 🧪🫧

🧪 Secrets for Success – Bubble-Powered Science!

Did you know the word **acid** comes from the Latin word *acidus*, meaning *sharp* or *sour*?
You've probably tasted an acid if you've ever sucked on a lemon — zingy, right? 🍋

In this experiment, when you mix **vinegar** (which contains an acid called *ethanoic acid*) or a solution of **citric acid** with **baking soda** (also known as *sodium hydrogen carbonate*), something fizzy and fun happens...

💥 A **chemical reaction** takes place — and loads of **carbon dioxide gas** is produced in just seconds! That's what creates all the exciting bubbles.

This is a special kind of reaction known as **neutralisation**, where an **acid** reacts with a **base** (the opposite of an acid). The result? A **salt**, **water**, and sometimes **carbon dioxide gas** — if the base includes a carbonate, like baking soda.

The Reaction Formula: **Acid + Base → Salt + Water (+ Carbon Dioxide)**

So, what's actually being made?

- **With vinegar**:

Ethanoic acid + Sodium hydrogen carbonate → **Sodium ethanoate** (a salt) + Water + Carbon dioxide

- **With citric acid**:

Citric acid + Sodium hydrogen carbonate → **Sodium citrate** (another salt) + Water + Carbon dioxide

This reaction happens super-fast — that's why it's perfect for launching mini rockets or creating fizzy fountains. Keep an eye on those bubbles... they're science in action! 🚀💫

Acids and Alkalis in Nature

🐝 Bee vs Wasp – Sting Science and Superpowers!

Did you know you can use chemistry to help reduce the pain of insect stings?

- **Wasp stings** contain venom that is **alkaline**. To reduce the pain, we can apply a **weak acid**, like **vinegar**, which helps **neutralise** the sting.
- **Bee stings** are the opposite! Their venom is **acidic**, so to help stop the sting, we use a **weak base** (alkali) like **bicarbonate of soda** mixed with water.

This chemical reaction between an acid and an alkali is called **neutralisation** – and it really helps take the sting out of a sting!

Bees and Wasps – What's the Difference?

Wasps are meat-eaters!
They hunt other insects like caterpillars, flies, and crickets to feed their young. That makes them **useful garden predators**– helping us by reducing the number of garden pests.

In **late summer and autumn**, wasps become a little more annoying…
The queen stops laying eggs, so worker wasps don't have larvae to feed. Instead, they start looking for **sugar** – so they buzz around our picnics, fizzy drinks, and sweet snacks!

Bees, on the other hand, are all about **flowers**!
They feed on **nectar** (for energy) and **pollen** (for protein). You might see honeybees near sugary rubbish or drink cans, but they aren't aggressive like wasps – they're just looking for a sweet treat.

One unusual wasp repellent is sliced cucumber! This vegetable has a chemical property which wasps just

Other Acids and Alkalis (Bases) in Nature (Bases are solids – Alkalis are bases that dissolve in water)

Substance	Where it's Found	Acid or Alkali	Fun Fact
Citric Acid	Lemons, Limes and Oranges	Acid	Gives citrus fruits their sharp, tangy flavour.
Tartaric Acid	Grapes	Acid	Used in baking powders (as cream of tartar)
Ethanoic Acid	Vinegar (made from fermented sugars)	Acid	Smells sharp and sour – used in cooking and cleaning
Ammonia	Animal waste, decomposing plants	Alkali	Has a very strong smell – used in many cleaners
Bicarbonate of Soda	Naturally in mineral springs	Base	Great for baking and neutralising acids.
Magnesium Hydroxide	Milk of Magnesia (medicine)	Base	Helps with indigestion – is only slightly soluble so works slowly and hence produces less gas!

Pupil Fact and Activity Sheet

Topic: Neutralisation

Name: _____

Date: _____

What did you discover during the Science of Dragons Show?

Scientific Sue used **red cabbage juice** to create a magical rainbow of colours:

Yellow Green Blue Purple Pink/Red

Question Time!

Q1. Can you remember why **purple cabbages** are labelled as **RED cabbages** in the shops?

_____

Sting Science: Using Chemistry to Soothe Stings

Bee and wasp stings can be painful and itchy — but did you know we can use **neutralisation** to help? Here's how:

- **Wasp stings** are **alkaline**, so we need a weak **acid** like **vinegar** to **neutralise** the sting and relieve the pain.
- **Bee stings** are **acidic**, so we need a weak **alkaline** solution to neutralise it. A mix of **baking soda** and cold water is ideal.

What is Neutralisation?

Neutralisation happens when an **acid** and a **base (alkaline)** react together to cancel each other out — the result is something **safer and more balanced**, like water and a salt.

🧪 Let's Become Chemical Detectives!

You're going to use your **red cabbage juice** to test a variety of household substances. This special purple liquid is a **natural pH indicator**, meaning it will **change colour** depending on whether a chemical is an **acid**, an **alkaline**, or something in between!

What to do:

1. Add a few drops of red cabbage juice to each liquid or dissolved substance.
2. Watch closely for any colour changes.
3. Record your results in the **Red Cabbage Chemistry Chart.**
4. Decide if the substance is **acidic**, **alkaline**, or somewhere in between.

💡 Need ideas for things to test?

- Try kitchen ingredients like **fruit juices**, **vegetables**, **condiments**, and **cleaning products**.
- You could also test **soaps**, **shampoo**, **salty water**, **milk**, or even **sparkling water**!

👉 Don't forget to **test only safe materials** — and check with your adult or teacher before trying anything unusual!

💡 Remember:

- Red/pink = Acid
- Green/blue = Alkaline
- Purple = Neutral - not acidic nor alkaline

💡 Fun Fact Corner: Did You Know?

Red cabbage contains a pigment called **anthocyanin**, which changes colour depending on the pH. It's found in many colourful fruits and vegetables like **blueberries**, **blackberries**, **grapes**, and even **purple carrots**! Can you think of other colourful plants that might make good natural indicators?

⚠️ Another Fun Fact: The Power of Caustic Soda!

Caustic soda (also known as **sodium hydroxide**) is a **super-strong alkali** that can turn your purple cabbage juice bright yellow — like magic!
But **watch out!** It's so powerful **it can** melt through grease, unclog drains**, and even** burn your skin

That's why **we never use strong acids or alkalis** in our experiments — **safety first!** We stick to safe kitchen items like lemon juice and baking soda instead.

Red Cabbage Chemistry Chart

Chemical	Colour change with purple cabbage juice	Acid	Alkaline
Vinegar	Red	√	X
Bicarbonate of Soda	Blue/Green	X	√
Honey			
Toothpaste			

Most Acidic **Red Cabbage pH Chart** Most Alkaline

Activity 4: Unmask the Gas

Discovering a New Dragon Firetype!

What you have:

- Citric Acid
- Baking Soda
- Candle

What you need:

- Vinegar – optional
- Clear glass beaker to place the candle into – optional
- 100 ml Water if using citric acid
- Funnel
- Safety Glasses
- 500 ml Bottle
- Balloon
- Lighter or matches
- Tongs to hold the inflated balloon with
- 2 Spoons

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.

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

Secrets for Success

- Using the funnel add 1 tablespoonful of baking soda to the balloon.
- Add 1/2 tablespoon of citric acid to 100 ml of warm water.
- Slowly add the water and citric acid solution to the 500 ml bottle.
- Carefully stretch the opening of the balloon over the mouth of the bottle without allowing any of the powder to enter the bottle.
- Hand this bottle back to the volunteer – they will be asked by Sue to gently lift the balloon holding the powder up – allowing the powder to drop on to the liquid in the bottle.
- At this stage lots of carbon dioxide gas will be made and the balloon will inflate – much to the joy of the class.

- The bottle will be handed back to you for you to remove the balloon and tie it off.

- Hand the balloon back to the volunteer – they are to hold it using the tongs (or a peg secured to a stick)
- You will then be asked to light the candle.
- The volunteer will then lower the balloon onto the flame – the balloon will burst but will not burst into flames! The volunteer will then be asked to go back to their seat.
- Place the candle into a small glass. This will help prevent any drafts from blowing the gas you will pour over the flame.
- Pour the invisible gas (carbon dioxide) carefully from the bottle over the candle. Pour it as though it were water or some other liquid.

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

Science in a Nutshell

Carbon dioxide, in liquid form, is found in some fire extinguishers. To maintain this liquid state, it's kept under specific pressures and temperatures, meaning an extinguisher can only be used once. When released, the liquid CO_2 quickly transforms into a gas, which is heavier than air and settles downward. When aimed correctly, this gas creates a protective "blanket" over the fire, cutting off oxygen needed for combustion and extinguishing the flames.

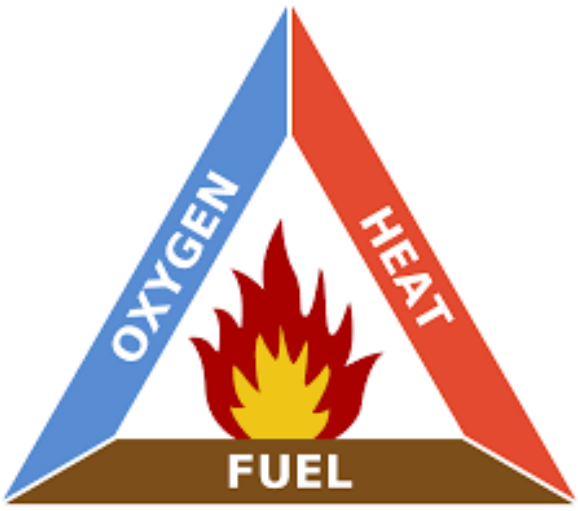
Carbon dioxide is also the gas responsible for the fizz in soft drinks and can be frozen under pressure to make dry ice, which sublimates directly from solid to gas under normal atmospheric pressure.

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.



Activity 5: Blast Off!

Training Meatlug to Hit the Target

What you have:

- Tube of effervescent tablets

What you need:

- Pot of extra lids (optional)
- Water
- Target (bin or box)
- Safety glasses
- Protractor (optional)

SAFETY:

This is a **high-energy reaction** that produces gas pressure — so let's make sure it's as **safe as it is exciting**:

- **Always point the rocket canister away from people** — especially faces — and keep everyone at a **safe distance** during launch.
- **Low ceilings?** Be careful — the lid may hit the ceiling and rebound in unexpected directions.
- **Indoor launches**? Wipe up any spilled liquid **immediately** to prevent slips.
- **Do not aim the rocket horizontally** — this can send liquid flying across the room!

🧪 Preparation Tip — What's in the Lid?

Inside the lid of some effervescent tablet tubes, you'll find:

- A **cardboard disc**
- **Tiny silica gel beads** underneath (these keep the tablets dry)

Before using the lid as a rocket, **remove the cardboard disc** and **dispose of the silica beads in the bin** — they're not needed and could cause a mess if launched!

Nuts & Bolts

As shown in the teaching video, this demonstration works well with the citric acid and baking soda – but the reaction is very fast and your volunteer will need to have the skill set to push the lid on to the tube containing the water and reacting chemicals really fast.

For this reason, I suggest using effervescent vitamin C tablets as the reaction is much slower but still just as explosive!!

🎯 Secrets for Success

Try this yourself before doing it with the children!

🚀 How to Launch Your Canister Rocket

1. Fill your **film canister** about **one-quarter full with water**.
2. Drop in your **powder mix or effervescent Vitamin C tablet**.
3. Quickly and firmly **push on the lid**, then **hold the canister at arm's length**, with the **lid pointing upwards**.

🔍 What's Happening?

As the tablet reacts with the water, **carbon dioxide gas** is produced. Unlike a balloon (which can expand), the canister **traps the gas**, causing **pressure to build up** inside.

Once enough gas accumulates, the **force of the pressure overcomes the friction holding the lid on** — launching the lid into the air! It may **travel up to 5 metres**.

⚠️ Safety Tips

- If your room has a **low ceiling**, hold the rocket **at an angle**, parallel to the ground and away from pupils — **not straight up**, to avoid rebound accidents.
- **Never point the rocket horizontally** — the lid may fly and the liquid will spill everywhere!
- For the **best launch distance**, angle the canister at **around 45 degrees**.

🔁 What Next?

- You can **repeat the launch** several times. Each time, the reaction slows and the lid will take longer to pop off.
- When no more gas is produced, **point the tube away from yourself**, gently remove the lid, and **dispose of the liquid safely**.

💡 Why not turn the tube into a real rocket?

See the next section for an investigation idea and a printable template to convert your canister into a flying rocket!

Science in a Nutshell

The Chemistry and Physics Behind the Pop!

When an **effervescent tablet dissolves in water**, a **chemical reaction** occurs, producing **carbon dioxide gas** — that's what causes the fizzy bubbles!

These tablets contain:

- **Sodium hydrogen carbonate ($NaHCO_3$)** — commonly known as **baking soda** (a base)
- **Citric acid ($C_6H_8O_7$)** — a weak acid

In solid form, the acid and base don't react. The atoms and molecules are locked in a crystalline structure. But when added to **water**, they dissolve and become mobile — **free to react!**

Here's the word-saving reaction equation scientists use:

$NaHCO_3$ (aq) + $C_6H_8O_7$ (aq) → $NaC_6H_7O_7$ (aq) + H_2O (l) + CO_2 (g)

💡 Just like learning a new language opens up a new world, **learning scientific language** gives you access to experiments, ideas, and discoveries. Master it — and there's no limit to what you can explore!

🚀 Let's Make Carbon Dioxide!

Safety First:

- If doing this as a class activity, go **outside** or use the **school hall**
- Mark a clear **safety line** for children to stand behind
- Children with **sensitive skin** should wear **gloves**
- Always point the canister **away** from faces and people

💥 What Happens Inside the Rocket?

When the tablet reacts with water:

- Carbon dioxide gas is released
- In a closed canister, gas builds up and **can't escape**
- Pressure increases as more gas particles collide with the container walls
- Eventually, the pressure **overcomes the friction** holding the lid on...
- **BOOM!** The lid pops off with force — often reaching **5 metres** in height!

The **tightness of the lid** affects how high it flies.
You'll also hear a satisfying **"whoosh"** as the gas escapes!

🚀 Newton's Laws in Action

This simple rocket demonstrates **all three of Newton's Laws**:

1. **First Law**: An object stays still unless acted on by a force — the gas creates the force that sends the lid flying!
2. **Second Law**: The more gas produced (mass) and the faster it pushes out, the more forceful the launch.
3. **Third Law**: For every action, there's an equal and opposite reaction — gas pushes down, the lid shoots up!

🧪 Turn It into an Investigation!

Get your young scientists to **test and explore**. But first, explain:
➡️ **To keep it fair**, you can only change **one variable at a time!**

Here are some variables they might investigate:

1. Amount of tablet used (whole, ¾, ½, ¼)
2. Volume of water
3. Water temperature
4. Size of container
5. Tablet form (whole pieces vs. powder)

Top Tip for Starting Simultaneously:

- Attach the tablet to the **canister lid using blu-tac**
- Pour water into the canister (not touching the tablet)
- Secure the lid and flip when ready!

Powder option?
Place a piece of **tissue over the canister**, add the powder on top, then carefully snap on the lid. When turned over, the water soaks the powder and triggers the reaction.

🧪 Pupils can work individually or in small groups.
Get everyone to **count down together** before turning their rockets upside down!

🚀 Design Your Own Rocket!

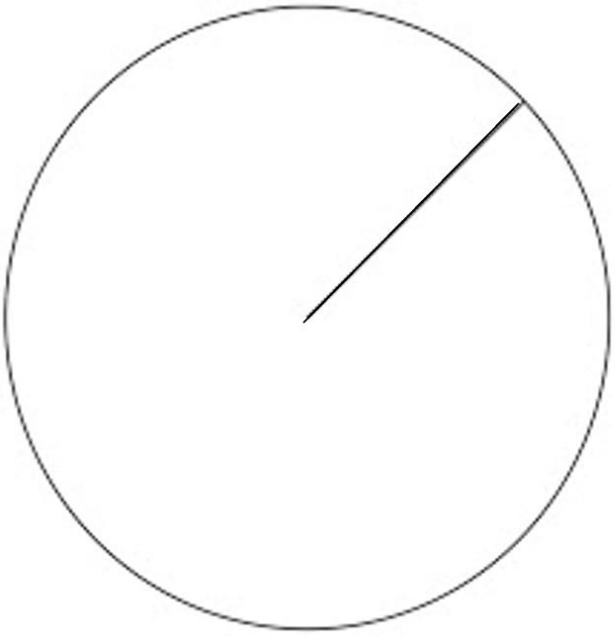
Use the **template below** to build a rocket casing around your film canister. Make it colourful, aerodynamic — and ready for lift-off!

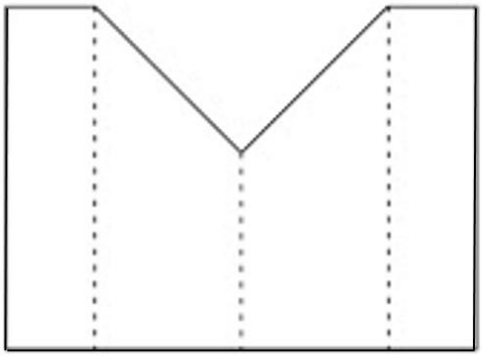
3 2 1...Lift off

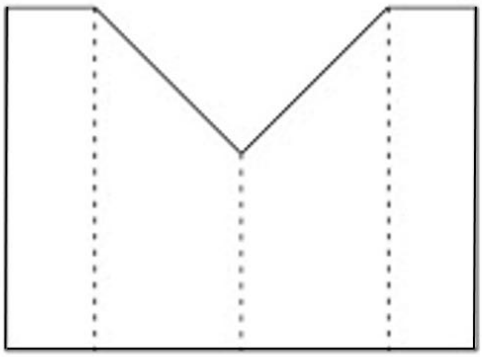
Rocket Template

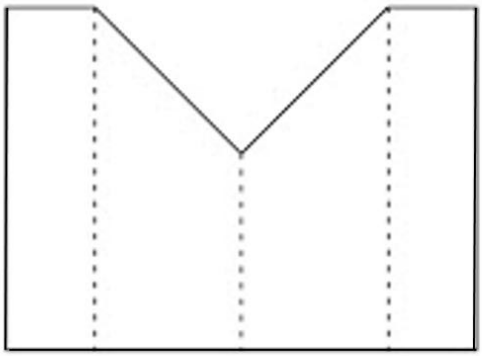
cut

fold









Activity 6: Train your Dragon

The Science of Balance

What you have:

- 31 x Dragon Templates
- Marker Pen
- 30 x Paper Clips

What you need:

- Scissors
- Colouring and art materials
- Pencil or wooden kebab stick
- 2 coins of the same denomination per child.
- Sellotape

SAFETY:

Care must be taken with scissors

Nuts & Bolts

With the aid of the template train a cardboard Dragon to balance on its nose!

The dragon can be balanced on a pencil tip or wooden kebab stick. Once balanced you can train it to spin by gently blowing it.

The balancing dragons are for the children to keep.

Secrets for Success – Balance Your Dragon!

✂️ **Cut out the dragon template.** Feel free to colour and decorate it to give your dragon personality!

☝️ **Try balancing the dragon on your fingertip.** What happens? It likely tips and falls — that's because its **centre of mass** isn't at the nose.

📍 **Find the natural balancing point.** For most dragons, it's around the **chest area** — this is called the **centre of mass**.

🌑 **Shift the centre of mass.** To make your dragon balance **on its nose**, we need to move its centre of mass forward by attaching **weights** to the ends of its wings.

- 📎 **Use paperclips (provided), coins, or plasticine.** These add the right amount of mass to stabilise your dragon.
- 🧱 **Adjust based on card thickness.**
  - If you're using thicker card (e.g., cereal box), you may need **more paperclips**.
  - Need more templates? Reprint from the teacher notes, glue to card, and cut them out again.
- 💨 **Once balanced — give it a gentle blow!** Watch your dragon **spin and twirl** through the air!
- 🧲 **Try using a magnet.** Paperclips are metal — so you can make your dragon spin by using the **invisible pull of magnetic force**!

Science in a Nutshell – The Balancing Dragon

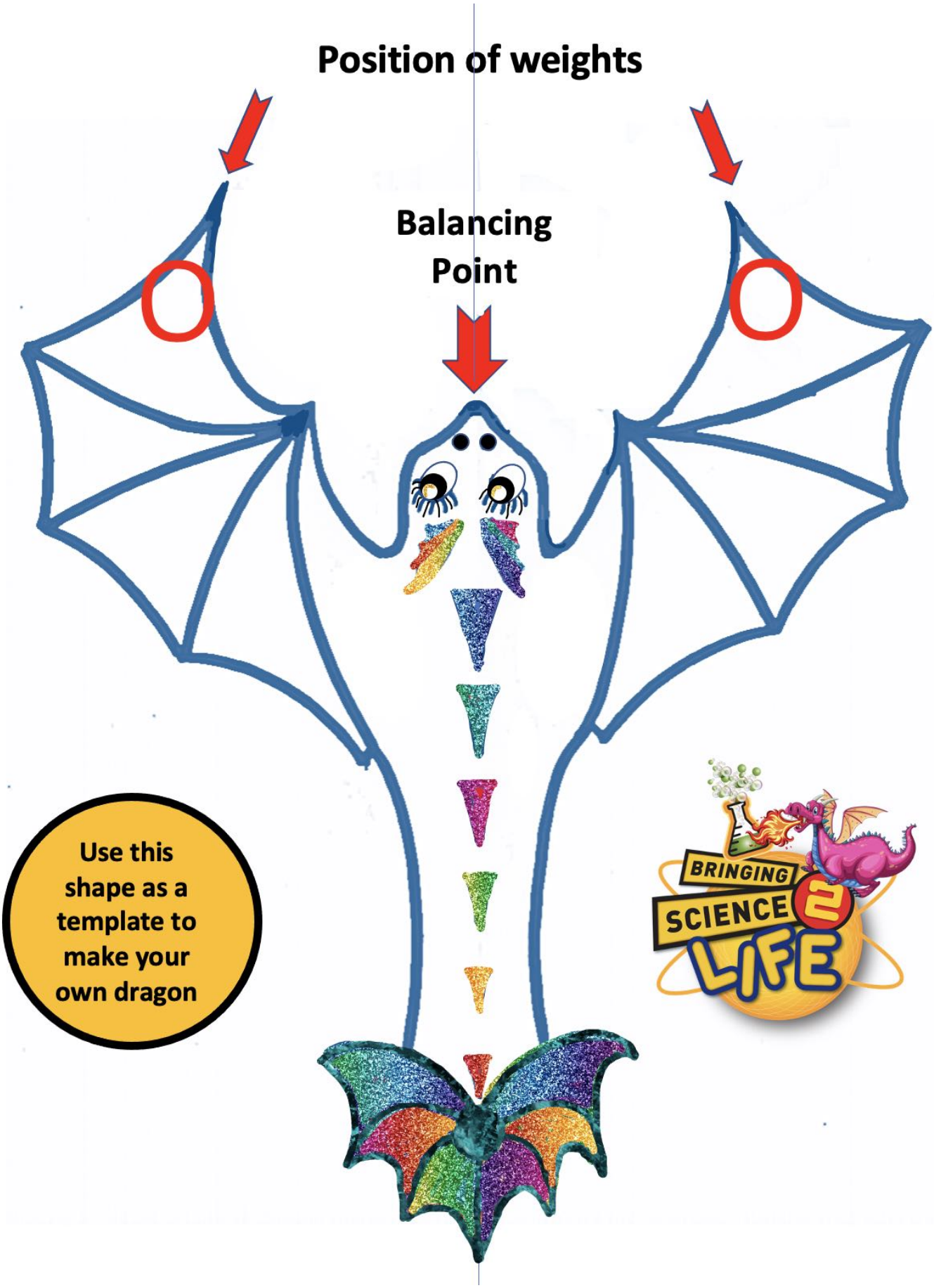
1. **Every object has a balancing point** called the **centre of mass** (or **centre of gravity**). This is the point where the object's weight is perfectly balanced.
2. **The lower the centre of mass, the more stable** the object becomes — that's why wide, low structures don't topple easily!
3. **In your dragon**, the centre of gravity has been shifted to the **tip of its nose**. This is done by **adding weights (like paperclips)** to the tips of the wings to counterbalance the rest of the body.
4. For many objects, especially those with **irregular shapes**, it's not always obvious where the centre of gravity is — it must be found by **trial and error**.
5. **Try this with everyday items!**
   - Uniform objects like pencils or rulers balance near the middle.
   - Irregular shapes, like a dragon or a coat hanger, require more investigation to find that perfect balance point.
6. **To find the centre of mass**, try balancing the object on your finger, a pencil tip, or the edge of a ruler. The spot where it **stays level without tipping** is the centre of gravity.

⚖️ Mass vs Weight – What's the Difference?

Mass is how much ***stuff*** is inside something — how much matter it's made of.
🧱 A brick has more mass than a sponge because it's packed with more *stuff*!
We measure mass in **kilograms (kg)**.

Weight is how strongly gravity pulls on that *stuff*.
🌍 The Earth pulls everything toward it — that's gravity!
We measure weight in **Newtons (N)**.

🧠 **FUN FACT:**
Your **mass** stays the same no matter where you are — Earth, the Moon, or Mars!
But your **weight** changes depending on how strong gravity is.
🪶 On the Moon, you'd weigh 6 times less — so you could bounce like a superhero!


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

💬 We'd Love Your Feedback!

We hope you and your pupils **enjoyed the show and workshop experience** — and we'd be delighted to hear what you thought!

📧 **Send your feedback or suggestions to:**
scientificsue@science2life.com

📸 Share the Science Magic!

We'd also love to **see you and your young scientists in action!**
Tag us or share your photos and videos using:

- 🔷 **Instagram/Facebook/Twitter**: @scientificsue
- 🔷 **Hashtag**: **#science2life**

Let's celebrate the fun, fizz, and fascination of science together!

With warmest thanks,
Sue
aka Scientific Sue

📧 scientificsue@science2life.com

Notes: