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Introduction

Creativity

Henri Matisse is famously supposed to have said that creativity takes courage. Scientists, engineers and mathematicians – those working on technological advances – can be just as creative as artists. You will struggle to find great discoveries that do not involve great creativity. Creative thinking is a process applying knowledge, intuition and skill to making or discovering something new – much like a scientific experiment. At one time the 'ingredients' were just individual entities, then the next moment you have taken them and created something that was not there before.

STEAM (science, technology, engineering, arts, mathematics) education and learning can be quite daunting. Never fear as Amazelab is here to show you just how colourful and creative these subjects can be. Using the imagery, make up and colours of the rainbow as our inspiration, we will take on scientific investigations and STEAM projects that will spark imagination and learning, either at home or in the classroom. Throughout this book we'll take on tricky subjects in a colourful, fun and creative manner, with a real emphasis on memorable learning.

Why a rainbow?

All of the activities in this book involve rainbows. Why? Because there is so much engaging science behind the colours and light. Rainbows capture children's imaginations and prove a useful hook into scientific investigation in the early years and beyond. Even as an adult, seeing a rainbow in the wild is an exciting and uplifting experience – and with a little know-how, you can create your own.

White light is made up of all the colours of the rainbow. The colour that you see is dependent upon the amount of light, and its colour, being reflected or absorbed by an object. Each colour that we are able to see with the human eye has a different wavelength and energy. Within the eye is the retina, which has two kinds of receptors – rods and cones – for perceiving light. Rods help us to see objects in dim lighting, and they respond to all wavelengths of the visible spectrum in low light. Cones are responsible for sending colour information to the brain, and they respond to specific wavelengths. There are three different types of cone receptors, which allow us to see coloured light. They are sometimes classified as red (L-cone), green (M-cone) and blue (S-cone), These aid us in distinguishing millions of colours. For us to see colours, there must be at least a small amount of light.

So, we've learnt that white light is a mixture of all the colours of the rainbow. What happens if we shine this white light through a glass prism? Well, the light slows down and bends, which in turn causes the colours to spread out into a spectrum. We call this the visible light spectrum, because it is made up of all the colours that we are able to see. In nature, a rainbow is formed when white light passes through rain droplets. As we know, the different colours contained in white light have different wavelengths, so when they are refracted through the droplets, the colours are separated.

Why not try it for yourself? You can create a rainbow by shining a light source – for example, a torch – through a prism or a glass of water. As we will see as we get stuck into the activities in this book, there are many other fun, creative and interesting ways to take inspiration from the colours of the rainbow.

Health and safety

Before we begin, we'll just need to go over a few words of warning.

Some of these activities will get messy! You may want to complete them outdoors or, if you are indoors, to use a protective surface (e.g. a large tray or plastic sheet). Remember that some ingredients – for example, food colouring – may stain, so please wear suitable clothing and wear rubber gloves to protect your hands.

Beware of any allergies, intolerances or sensitivities to the ingredients used in the activities.

Care must be taken when using knives, scissors or boiling water. Adult intervention is advised.

Children must be under the constant supervision of an adult when completing the activities.

THE ACTIVITIES

Activity 1

Exploding rainbows

Chemical reactions

You will need

- 1 x jug
- 1 x teaspoon
- 1 x protective sheet
- 7 x small clear containers
- Food colouring (red, orange, yellow, green, blue, indigo, violet)
- Baking soda
- White vinegar

The instructions

1. This activity is a bit messy, so work outside or use a protective sheet. Place your seven containers in a row, and add a teaspoon of baking soda to each container.
2. Add two drops of food colouring to each container – red food colouring to the first container, orange to the second, yellow to the third, green to the fourth, blue to the fifth, indigo to the sixth and violet to the seventh. (If you don't have all the rainbow colours, you can just use whichever colours you do have.)
3. Pour vinegar into each of the containers. Aim for twice as much vinegar as baking soda. The reaction will happen quickly, so be sure to step away, watch carefully and enjoy your exploding rainbow.

The science

Baking soda and vinegar react chemically because one is a base and the other is an acid. Baking soda is a basic compound with the scientific name 'sodium bicarbonate'. Vinegar is a diluted solution containing acetic acid. When we see the two react, it is, in fact, two separate reactions. The first is the acid–base reaction. When vinegar and baking soda are first mixed together, hydrogen ions in the vinegar react with the sodium and the bicarbonate ions in the baking soda. The result is that two new chemicals are formed: carbonic acid and sodium acetate.

The second reaction is a decomposition reaction. Carbonic acid (formed as a result of the first reaction) immediately begins to decompose into water and carbon dioxide. This gas is the same as you would find in a carbonated drink. The carbon dioxide rises to the top of the mixture. This creates the bubbles and foam that you see when you mix baking soda and vinegar.

$$C_2H_4O_2 + NaHCO_3 \rightarrow NaC_2H_3O_2 + H_2O + CO_2$$

vinegar + sodium bicarbonate → sodium acetate + water + carbon dioxide

Next level learning

How does the shape of the container influence the chemical reaction? If you mix a large amount of baking soda and vinegar in a small container with a narrow opening, expect an impressive explosion!

What ratios of vinegar to baking soda produce the largest volume of gas and the most impressive explosion? You could simply measure the height of the bubbles produced with a ruler.

Create different colour combinations to investigate primary and secondary colours.

Investigate rainbows in light and nature.

Making curriculum links

Early years foundation stage (EYFS)	Active learning, playing and exploring, thinking critically, creating with materials, experimenting with colour, explaining processes, fine motor skills, building relationships, managing self, speaking, listening, communication, attention and understanding.
Primary	Reading and following instructions, mathematics, working scientifically, materials, light, art and design.
Secondary	Working scientifically, particles, atoms, elements and compounds, chemical reactions, gas tests, pressure, colour, chemical changes and chemical analysis.

Activity 2

Rainbow bridge

Capillary action

You will need

- 7 x clear containers
- Paper towels
- Water
- Food colouring (red, yellow, blue)

The instructions

1. Place your containers in a row. Add water to the first, third, fifth and seventh container.
2. To the first and the seventh container, add five drops of red food colouring. (You could use another colour if you don't have red, but you will need the colours specified to create a rainbow.) To the third container, add five drops of yellow food colouring. To the fifth container, add five drops of blue food colouring.
3. Make six wicks using paper towels. Take a sheet of paper towel, cut it in half, fold it in half lengthwise, fold lengthwise again, then twist.
4. Place your first wick in your first container, so that the end is in the water. Bend the wick and place the other end in the second container. Place one end of your second wick in your second container, and bend it so the other end touches the water in the third container. Repeat.
5. Now wait for your rainbow bridge to form.

The science

Your rainbow bridge is formed as the water travels up the paper towel by a process called capillary action. This is the ability of a liquid to flow upward, against gravity, in narrow spaces. The same principle is used to help water climb from a plant's roots to its leaves. Paper towels are made from fibres called cellulose, which are found in plants. In this activity, the water flowed upwards through the tiny gaps between the cellulose fibres. These gaps act like capillary tubes, pulling the water upwards. Water is able to defy gravity in this instance due to the force of attraction between the water and the cellulose fibres. Using the process of adhesion, the water molecules cling to the cellulose fibres in the paper towel. Cohesion is responsible for the water molecules attracting to each other, meaning that, as the water moves up the tiny gaps in the paper towel fibres, the cohesion forces help to draw more water upwards. Adhesive forces between the water and cellulose, plus the cohesive forces between the water molecules, will be overcome by the gravitational forces on the weight of the water in the paper towel. When this happens, the water will stop travelling up the paper towel.

Next level learning

Why not complete your own plant investigation to research capillary action further? Dissect a plant to take a closer look at its structure (cut flowers can work as long as they are relatively fresh). Experiment by keeping plants in different conditions (e.g. dark, light, dry soil, moist soil) and seeing what you notice.[1]

Build a bridge looking at different structures and techniques used for successful builds.

1 For inspiration and growing kits, see: https://www.plantletculture.com/.

Grab a microscope and study the structure of the paper towel. What do you see?

Investigate different types of paper – for example, toilet paper, newspaper, pages from a magazine. Alter the length and thickness of the paper. Vary the volume of water that you start with and see how long it takes the water to reach the empty glass.

Making curriculum links

EYFS	Active learning, playing and exploring, thinking critically, using materials, experimenting with colour, fine motor skills, managing self, attention and understanding.
Primary	Reading and following instructions, mathematics, working scientifically, recording results, forces, materials, colour mixing, everyday materials, living things and plants.
Secondary	Working scientifically, recording results, experimental skills and investigation, analysis and evaluation, measurement, structure and function of living things, forces, materials and transport systems.

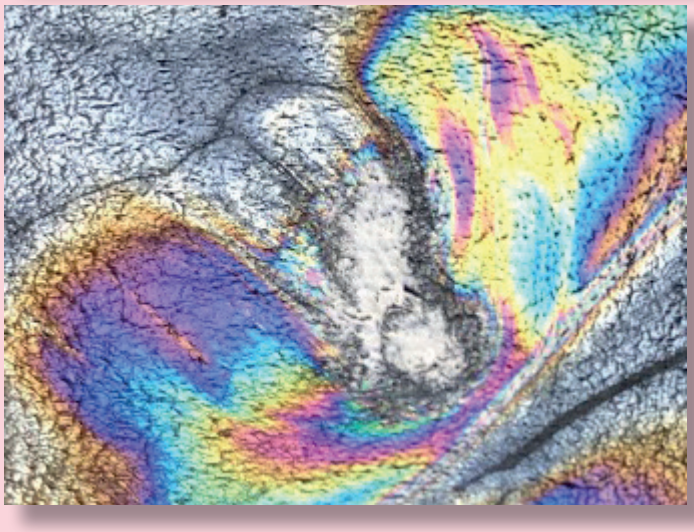
About the author

Leonie Briggs is a science teacher, STEAM lead, STEM Ambassador, CREST Assessor and Director of Amazelab. With a varied background in STEM – ranging from veterinary and general practice to orthopaedics – she eventually discovered her passion for education and has held various roles as a primary, secondary, post 16 and alternative provision teacher specialising in science and chemistry.

Leonie's dedication has won her multiple accolades, including 'Outstanding New STEM Ambassador' (STEM Inspiration Awards, 2022), nominations for the Global Teacher Prize (2021) and the National Teaching Awards (2022), recognition as one of the UK's Top 100 Female Entrepreneurs (2025) and a Green Growth Awards finalist (2025).

Under her leadership, Amazelab has won UK Enterprise Awards for STEAM Education (2023 & 2024), Start-Up Business of the Year (2022) and STEAM Education Platform of the Year (2025).

Useful videos are available on the Amazelab YouTube channel: https://www.youtube.com/channel/UCPJVGxCQUA6mYsXy9XecqzQ/videos



Looking to add some STEAM to your day, but unsure of the best way to do it?

Dive into these 40 quick, easy and fun rainbow themed activities that will inspire young people to discover, interact with and enjoy STEAM (science, technology, engineering, arts and maths) subjects.

Examples include:

- Rainbow Trail: Are you able to create a rainbow from nature in the home or classroom?
- Bubbles: Understand the colour and structure of bubbles in this mesmerising experiment.
- Plant Growth: Discover what colour light allows plants to grow best.
- Make Your Own Rainbow: Experiment with white light to make your own rainbow.

Suitable for teachers, community group leaders, parents and carers with an interest in STEAM subjects.

Leonie Briggs reminds us that our imaginations are the pots of gold at the end of every rainbow, particularly those rainbows we make ourselves!

Ian McMillan, writer and broadcaster

Leonie beautifully highlights the ability to blend creativity, science and hands-on learning. The book captures how STEAM subjects can be both engaging and imaginative, making complex concepts accessible through vibrant projects.

Grant Bowman, MD, Coaching for Change

What a joy this book is. So many amazing things to do. All the activities are explained so well and will be an inspiration to homes and classrooms across the world.

Andy Sorsby, Management Consultant, FCS Associates Ltd and Business Advisor to Business Sheffield

This is the perfect book for both parents and teachers who are looking to spark imagination and learning. A fantastic resource to dip into again and again!

Emily Hunt, primary teacher and author of the 15-Minute STEM book series

Leonie Briggs is a science teacher, STEAM lead, STEM Ambassador, CREST Assessor and Director of Amazelab. Her dedication has won her multiple accolades, including 'Outstanding New STEM Ambassador' (STEM Inspiration Awards 2022), nominations for the Global Teacher Prize (2021) and the National Teaching Awards (2022), recognition as one of the UK's Top 100 Female Entrepreneurs (2025) and a Green Growth Awards finalist (2025). Under her leadership, Amazelab has won UK Enterprise Awards for STEAM Education (2023 and 2024), Start-Up Business of the Year (2022) and STEAM Education Platform of the Year (2025). **@amaze_lab**

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