Met Office

I can make a rainbow

Overview

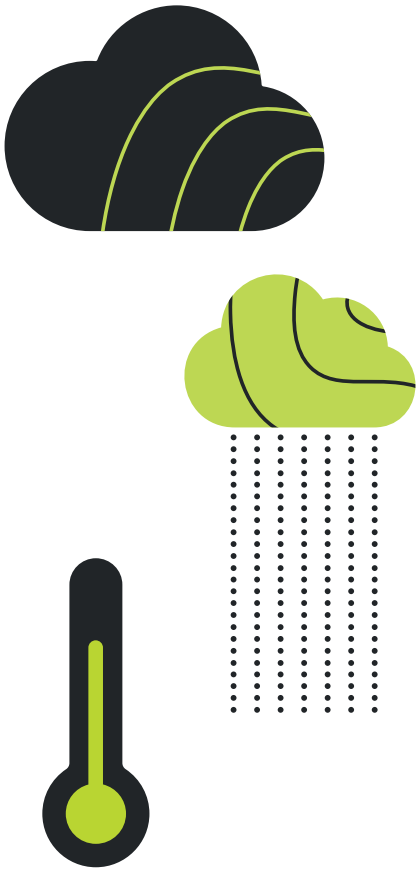
The properties and behaviour of light, and how it interacts with droplets of water, give rise to one of nature's most colourful meteorological events - the rainbow. This activity will look at how rainbow form and then guide you through making rainbows in your homes.

Time required

45 minutes

Materials required

- Mirror
- Water
- Clear glass (fill about ¾ full)
- Internet
- Spray bottle/hosepipe spray (Outdoor rainbows)
- Crayons
- Camera (optional)



Activity Steps

01

What is a rainbow, who discovered this and how do they form?

When have you seen a rainbow? Have a discussion with your family when and where they may have seen one. What was the weather doing at the time?

A rainbow is an arc-shaped spectrum of light which is created by refraction and reflection.

The Greek philosopher Aristotle first started musing about rainbows and their colours back in 350 BC. His ideas were picked up and elaborated upon by the Roman philosopher Seneca the Younger in his Book 1 of Naturales Quaestiones around 65 AD. Senaca was surprisingly ahead of his time in his reasoning, even predicting the discovery of the prism effect by Newton centuries later.

Throughout the ages, thinkers, philosophers and naturalists examined the phenomenon of the rainbow effect, noting its appearance not just in the sky but in other circumstances too.

But in every case, two elements were essential for that characteristic burst of colour, water vapour or droplets and sunlight. Finally, Isaac Newton proved that white light is made up of a spectrum of colours by splitting light with a prism. His discovery, together with the work of others before him, finally explained how rainbows form.

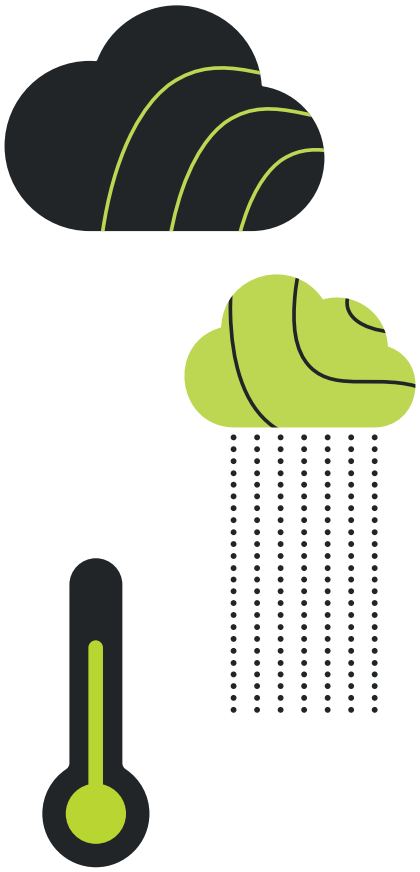
He also noted that the sequence of the colours of a rainbow never changed, always running in the same order. He coined the idea that there are seven colours in a spectrum: red, orange, yellow, green, blue, indigo and violet (ROYGBIV) We will talk about this a bit later.

How do they form?

Rainbows are caused when rays of light from the Sun hit water droplets which reflect some of the light back towards an observer. The water droplets are usually raindrops, but could also be spray from a waterfall, a fountain, or even fog. To see a rainbow, you must have the Sun shining behind you and the water droplets in front of you.

Sunlight is made up of a spectrum of different colours that look white when we see them all mixed together. Since light travels more slowly through water than air, the light is bent as it enters the raindrop and becomes refracted, splitting the light into the spectrum of colours. Some of the light is reflected off the internal surface at the back of the raindrop, which works like a mirror to reverse the order of the colours to provide the familiar sequence of a rainbow.

The amount of the rainbow arc that is visible depends on how high the Sun is in the sky. When the Sun is very high, you may see a rainbow that only just appears above the horizon. On the other hand, if you are lucky enough to see a rainbow from a plane or the top of a mountain you might be able to see the whole circle. You can find more information here **here**.



02

Time to create your own rainbows.

Using the instructions below you will be able to make your own rainbows inside and outside your home.

Indoor rainbow (clear glass, mirror, white paper. Optional - torch)

Following these steps below you can create a rainbow in your home:

- Fill a clear glass or clear tub halfway with water.
- Place a mirror inside the glass, prop the mirror so that part of the mirror is under the water and other part is out.
- Place the rainbow maker glass near a sunny window or sunny place in your house with direct light coming in so that it hits the mirror.
- Play around with holding a large white piece of paper above the maker to “catch” the rainbow. You might have to move a bit until you find it or finding the rainbow on a wall near the mirror.
- Play around with moving the paper closer to the mirror and then farther away to see how your rainbow changes!
- Take a picture of your rainbow for remembering later.

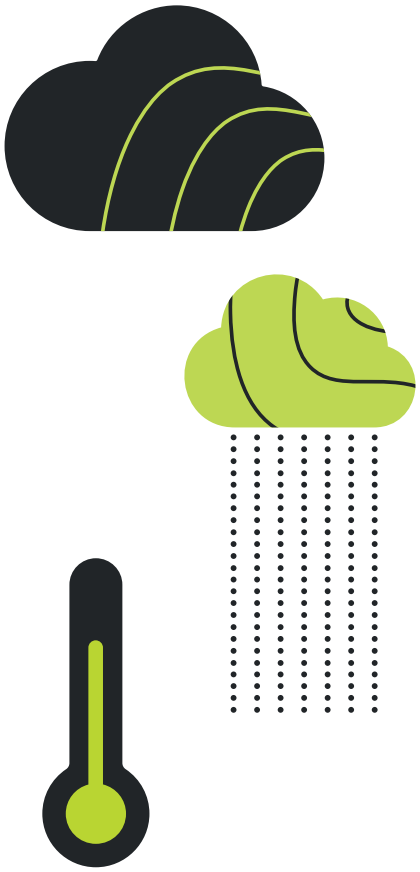
Tip / Safety notice

You should never look directly at the sun, so make sure that you do not look directly into the reflection of the mirror. If you’re concerned about this, try the experiment in a dark room with a torch shining on the glass.

Outdoor rainbow experiment (hose/spray bottle, sunlight)

Using these steps below, you will be able to make a rainbow outside:

- Find a sunny place outside. You’ll need to stand with your back against the sun, so you are facing away from it.
- Start by creating a mist, instead of a stream of water, so that the sun has to pass through. You can do this by holding your thumb over the end of the hose or having a mist position on your hose.
- Once you have created a mist using the hose, turn the hose so that the sunlight passes through the mist. You will be able to see a rainbow forming in the mist. This happens because the sunlight is being refracted in the small droplets of water.



03 Make

What colours did you see when you made your rainbows earlier? Did you see these colours in the rainbow **red, orange, yellow, green, blue, indigo, violet?** The idea that there are seven colours in the rainbow still lasts to this day. At a glance, you might think this to be true, but closer inspection of a rainbow shows that there are far more than just seven individual hues.

A rainbow is not a pure spectrum. It is actually made up of a myriad of individual spectral colours that have overlapped and mixed. The basic sequence for primary rainbows is always the same running from; Red (the longest wavelength at around 780 nm) through to Violet (the shortest wavelength in the sequence at 380 nm).

The seven colour idea is still a popular one and it helps remember the order of the most recognisable colours in a rainbow. However, remember that there is also a whole range of colours, so many that we cannot distinguish them all with the naked eye.

Tip

You can find more information on the colours in the rainbow here

Using the colours that you have seen when making your own rainbow; can you draw and decorate your own rainbow on a piece of paper? Can you draw the colours in the order of what you saw?

Did you know?

Did you know that some rainbows form at night?
When the sun goes down a rarer version of this natural lightshow can be seen - the moonbow, also known as a lunar rainbow! You can read more about Moonbows here.

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