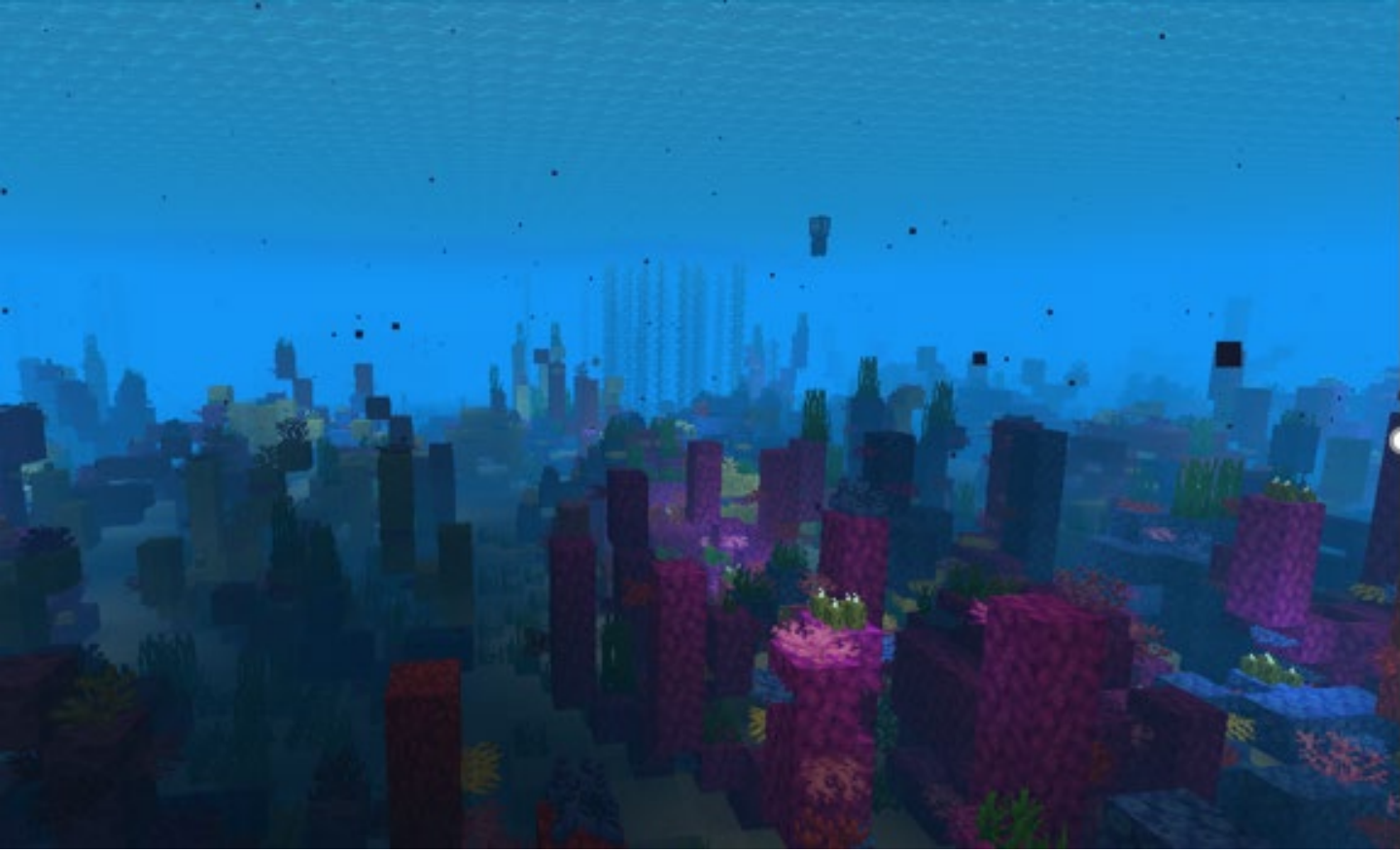


Exploring chemistry in the environment in Minecraft: activities

Resources for engaging children with chemistry in the environment through the computer game Minecraft

Investing in the Future of Science

Science HUNTERS

ROYAL SOCIETY OF CHEMISTRY

Lancaster Environment Centre | Lancaster University

UWE Bristol University of the West of England

SCU | science communication unit

Contents

About these resources

These resources are designed to be used by parents/carers or teachers, to help children learn about chemistry in the environment. They can be used with any version of Minecraft.

Each activity comes with:

- a brief introduction to the topic
- a non-Minecraft activity to try
- three Minecraft challenges: starter, medium and advanced.

Questions for children are included in the activities and challenges. Challenges can be worked through sequentially, or undertaken independently of one another as desired.

They are broadly aimed at ages 7-11 years, but not restricted to these age groups. Adults should decide what is suitable.

It doesn't matter if things don't work out the first time!

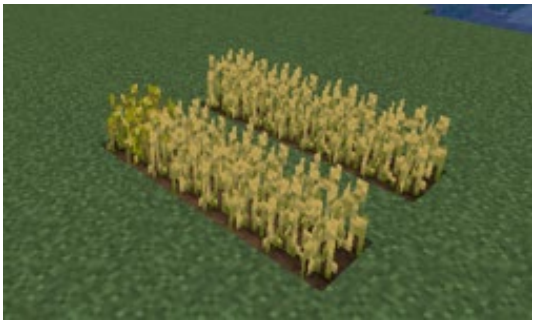
There's no right or wrong result; everyone's creations and approaches to the challenges will be different. What's important is thinking about the challenge, and having a go.

The challenges are best completed in Creative mode, where access to blocks is unlimited.

Please note that included links open external webpages.

If you don't have access to Minecraft, alternatives include Lego, drawing, hands-on activities, or exploring some of the alternative games available, including those that are free-to-access. Free trials are also available; trial length depends on the device used. This is not an official Minecraft resource.

Farming and food: topic information



Food security happens when: everyone can access **enough safe** and **nutritious food** to be **healthy**, and this can be **sustained** for the **future.** But this isn't easy!

The United Nations says we could have **9.7 billion people** by 2050. Find out more about feeding them sustainably from the World Resources Institute and try this short video from BBSRC for more about the **challenges** of Food Security.

What might help? We could find ways to produce food without taking up as much space – you could try designing a solution later in the **Challenges** for this topic!

Plant crops need a few things to grow well: **air, light**, **water, warmth** and **nutrients** (chemicals). Try BBC Bitesize to find out more.

Although seeds can **start** to grow without added nutrients (try this out in the **Activity** for this topic), they need them to **keep** growing and stay healthy.

Fertilisers are **food for plants**. They provide **concentrated nutrients**, to boost plant growth and crop yield (how much you get).

Bone Meal acts as a **fertiliser** in **Minecraft** – and in **real life**!

However, they are not a simple solution. They can cause problems such as too much plant growth in rivers. Find out more from Frontiers for Young Minds.

Farming and food: activity

Germinate some seeds and watch their roots and shoots develop!

Equipment

Freezer bag
Paper towel
Staples
Seeds of your choice

Instructions

1. Put the paper towel in the freezer bag and add some staples across the bag, about a third of the way up.
2. Put several seeds in the bag, sitting on top of the staples so they don't fall to the bottom of the bag.
3. Add some water, so that the bottom of the paper towel is wet.
4. Put your seeds somewhere where they have warmth and light, and keep the paper wet. You should see roots, and then shoots, start to form over time.
5. If you want to keep growing the plant, move the seedling to soil.

Why do the seeds need air, water, light and warmth? What else do they get when you move them to the soil?

Farming and food: challenges

Starter

Plant some seeds in Minecraft. Open the inventory (press E) and choose three different types. Tip: search for 'seeds' to see the options. Think about where to plant them. **What is essential for them to grow? Is this the same in Minecraft and the real world?**

Medium

Conduct an experiment. Choose a type of seed to plant from the inventory. Plant the seeds in two groups. Add fertiliser (bone meal) to one group, and place some water in the adjacent blocks. Don't do this for the other group. **Which grows faster? Why? How does this compare to the real world?**

Advanced

As the world's population grows, there will be less space to produce food in because infrastructure for more people will take up more space. But, there will be more people needing food. **Design a space-saving farm** to solve the problem. It could be on land, at sea, in trees…

If you don't have access to Minecraft, try extending the germination activity to include experiments in different conditions (e.g. somewhere dark), and design a farm on paper.

Coral reef conservation: topic information

Image: Francesco Ungaro on Unsplash.

Coral reefs are **large underwater structures** made of marine invertebrates (their skeletons are outside of their bodies) called corals. They **support many other plant and animal species**.

Fishing is important at coral reefs, so they are essential for **food security**. They also **protect settlements** from hurricanes, typhoons and tsunamis. But various things **threaten** them.

Global warming changes seawater **chemistry**, so corals **cannot grow** as easily and are weaker and more easily damaged.

Oceans get **warmer,** so the algae that give corals their colours and nutrients leave. The **corals die** and turn white, or '**bleached**'.

As glaciers melt, **sea levels rise**. Corals become **deeper** underwater and can't get enough sunlight to help them grow.

Crown-of-thorns starfish eat living coral reefs, while **fishing nets** caught in corals damage them. **Dynamite** is sometimes used to make fish swim towards nets, causing a lot of damage.

Image: BUH at German Wikipedia(Original text: BUH), GFDL, via Wikimedia Commons

Conservationists and scientists check corals reefs to look for warnings that they are unhealthy or damaged.

Glass-bottomed boats let them see the coral reef from above. They can then work out what is causing damage, and find solutions to help.

Coral reef conservation: activity

Match the picture to the threat to coral reefs! Answers on next page.

jon hanson on flickr, CC BY-SA 2.0, via Wikimedia Commons

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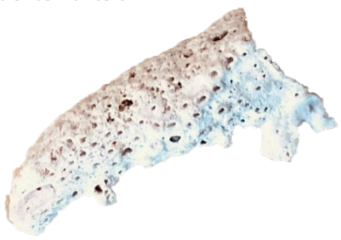

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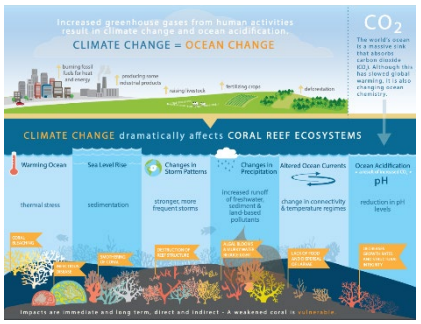

NOAA: National Ocean Service, Public domain, via Wikimedia Commons

Coral dies and becomes 'bleached'

Dynamite damages reefs

Global warming causes problems such as deeper and more acidic water and reefs cannot grow properly

Crown-of-thorns starfish eat coral

Nets get caught on coral reefs

Coral reef conservation: activity

Use this page to practice pencil control too if you like!

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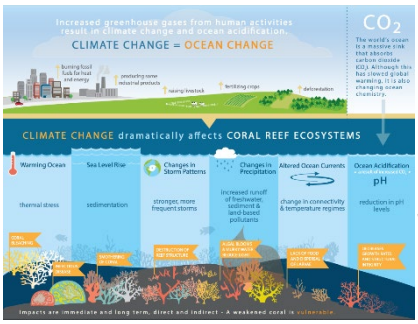

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Crown-of-thorns starfish eat coral

Nets get caught on coral reefs

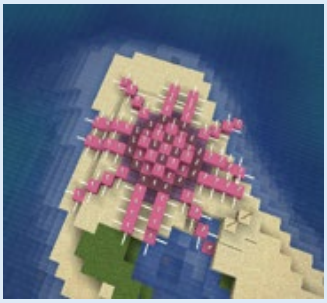
Coral reef conservation: challenges

Starter

Find a shallow sea. Tip: try using the seed code ‘ickart’. Build some **healthy** (colourful) and **bleached** (white coral). **What could have bleached the coral?**

Medium

Build some coral reef and then build a **threat** to it. This could be, for example, and illegal fishing vessel or a crown-of-thorns starfish.



Advanced

Build a glass-bottomed research ship that scientists could use to observe a coral reef and see whether or not it is healthy. **What features does the ship need to have, and what equipment might the scientists need to take on board with them?**

If you don’t have access to Minecraft, you could try using Lego, junk modelling or drawing to make your creations.

Lava flows: topic information

Lava erupts from volcanoes. There are different types of lava, depending on their **chemistry** (what they are made up of).

Lava chemistry is a bit like a **recipe**: if you put different things in, you get different types of lava.

Lava chemistry controls how **runny** or **sticky** ('viscous') it is.

Lava can **damage roads**, **houses** and other **infrastructure**. **Runny** lava can move **faster** and **travel further** than sticky lava. Find out more from the United States Geological Survey (USGS). Sometimes things can be done to prevent or **minimise damage**, such as creating structures that stop or divert lava.

In Iceland in 1973 **seawater was sprayed onto advancing lava** to cool it down. You can find out more and see some images from the time from the USGS.

Lava colour also depends on its chemistry. **Runny** lava is usually **darker** in colour, and erupts at **higher temperatures**. Find out more from the Geological Society of London.

'Sticky' lighter coloured lava (rhyolite). Image: USGS, Public domain, via Wikimedia Commons.

'Runny', darker coloured lava (basalt). Image: Jstuby, CC0, via Wikimedia Commons

Chemistry at volcanoes can also result in some unusual colours, such as lava that looks blue at night! Find out more from the European Geosciences Union.

Lava flows: activity

Test out flows in real life!

Equipment

Fluids of different viscosities (thicknesses). Use what you can spare and safely use, e.g. mixing mud with different amounts of water, or perhaps small amounts of something like shower gel and washing up liquid.

A **sloping surface** you can put your fluids on, like a piece of smooth ground that slopes, or a plastic lid (make sure it's something that is safe to get dirty, safe to tilt, and you can easily clean afterwards).

Instructions

1. Put a blob of each liquid on your surface.
2. Tilt the surface (or watch what happens if you're using sloping ground).
3. Do all the fluids move?
4. Which fluid moves fastest? Which is slowest?

Why do some fluids move more quickly and easily than others? What could you do to change their speed? How could you change where the flows go?

The Sapienza barrier stopped a lava flow from Etna reaching buildings in 1983 Image: Jack Lockwood, USGS (public domain).

Lava flows: challenges

Starter

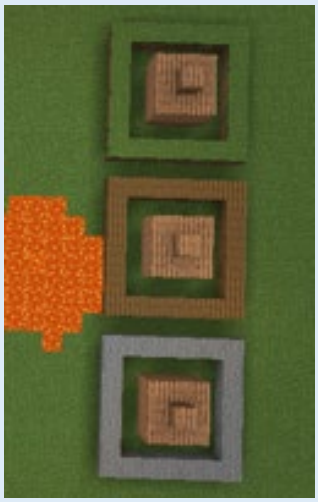
Place lava in different areas, including flat ground and slopes. **Does the lava spread out differently in different places? What happens when it meets other objects?**

Medium

Build a volcano. **What features does it need?** Don't forget a magma chamber inside, and a vent for lava to erupt from. BBC Bitesize shows the inside of a volcano.

Advanced

Protect buildings from lava flows. **Which materials work best to stop the lava damaging buildings?**



Why do some materials work better than others?

How could you make the lava flow in different directions? How could you stop it?

If you don't have access to Minecraft, you could extend the viscosity activity to compare how quickly the flows reach an object or finishing line and how you could change their course, and draw a volcano diagram on paper.

Useful links and further information

Find out more about the Science Hunters programme on its project pages at Lancaster University and UWE Bristol.

For more information about the available editions of Minecraft and potential alternatives, try this pdf guide from Building to Break Barriers (a Science Hunters project).

Minecraft provides a wide range of lessons on different subjects, created by educators around the world.

The activities included here are based on Science Hunters sessions. Please see these links for more information on each:

Using Minecraft to engage children with botanical topics (BGCI, 2018, pages 20-23). Please note this links opens a pdf file.
Exploring coral reef conservation in Minecraft (ASE, 2020)
Digging deep into Geosciences with Minecraft (AGU, 2018)

Internet Matters provide a Parents' Guide to Minecraft.

Produced for *Investing in the Future of Science: UK environmental science engagement* based on Science Hunters sessions. Original session development was funded by Lancaster University via Widening Participation, Outreach and Research Impact grants. The coral reef conservation session used to inform this activity was developed with support from Professor Nick Graham. Adaptation of sessions into these resources was supported by the Royal Society of Chemistry. Not an official Minecraft resource.