BRITISH SCIENCE WEEK

SECONDARY ACTIVITY PACK

6 – 15 March 2020
britishscienceweek.org

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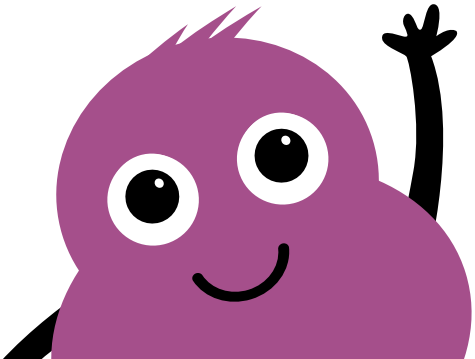

BRITISH SCIENCE WEEK

This resource pack is your 'one-stop shop' for supporting you during British Science Week, but it can be used at any time. Feel free to adapt or extend the activities to suit your students' needs and the curriculum you are delivering.

In addition to the activities in this pack, there are lots of other ways to enthuse and engage your students throughout British Science Week. In developing this pack, we have looked for activities which break down the stereotypes surrounding science, technology, engineering and maths (STEM) and that promote cross-curricular learning. We encourage you to use British Science Week as an opportunity to link STEM to other curriculum subjects and to your childrens' own backgrounds, lives and interests.

This year we've got some fantastic activities to complete in school, plus some designed for students to take part in at home with their families.

Events

You can either create your own club, class or school event or search for things happening near you. Last year we reached more than 180,000 people. Help us make British Science Week 2020 even bigger and better! Visit britishscienceweek.org

This year, our activity pack theme is '**Our diverse planet**' - celebrating the amazing diversity we see across the world. From biodiversity to cultural and societal diversity, from the diversity of knowledge to STEM careers and subjects. There are lots of ways to explore this theme - we'd love to hear some of your ideas too!

#BSW20

Poster competition

look out for the paintbrush symbol at the top right corner of the page.

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Contents

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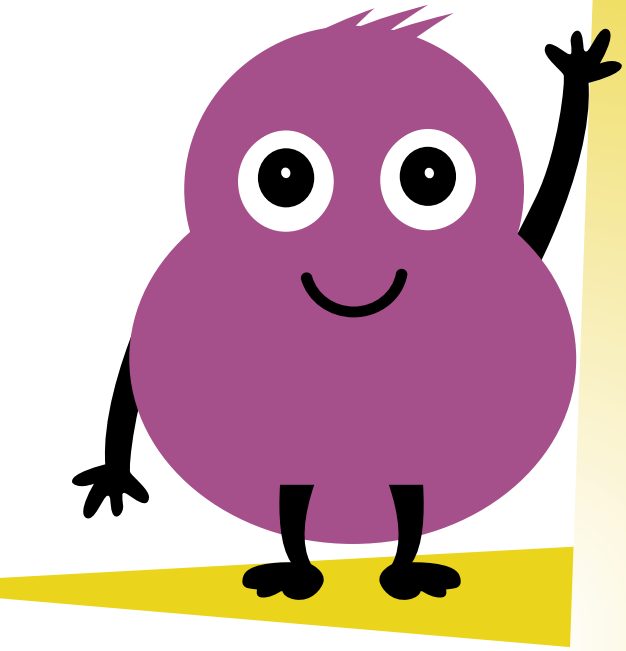
Making the most of volunteers

Volunteers could be a wonderful asset to your British Science Week adventures. Volunteers like STEM Ambassadors offer their time and enthusiasm to help bring STEM subjects to life, demonstrating their value in life and careers. The *Inspiring the Future* website can match you up with someone who has the skills you're looking for.

Volunteers come from a range of careers and experiences, from engineers, designers and architects to scientists and technicians – be sure to take advantage of this so students can see all the options available to them in the future!

Check out *STEM Learning*'s website for some handy tips on how to get a STEM Ambassador: stem.org.uk/stem-ambassadors/find-a-stem-ambassador

Visit *Inspiring the Future's* website for some helpful ideas of events you can use volunteers at: inspiringthefuture.org/schools-and-colleges/resources-and-guides



Here are some ideas and tips on how you could involve volunteers this British Science Week:

- Kick off with a volunteer-led talk/demo, getting young people excited to take part in the rest of the Week.
- Invite a different visitor each day to keep students engaged throughout.
- Where available, choose volunteers/ambassadors who go against stereotypes the students might have of people who work in or engage with science e.g. female engineers.
- Reserve visitors early (many speakers get booked up during British Science Week), have a clear idea of what you want them to do and communicate this with them ahead of time with a brief.

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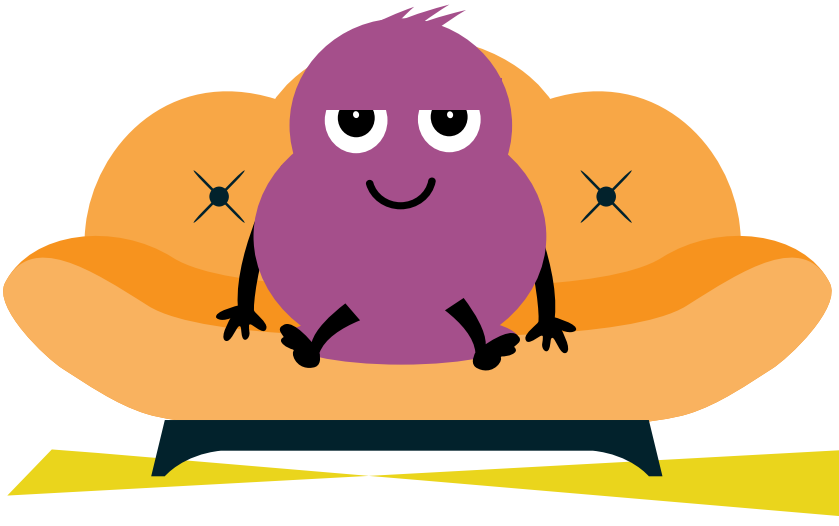

British Science Week at home

Want your students to enjoy British Science Week at home, but not sure how? Here are our top tips for engaging parents and carers so the fun doesn't stop at school:

1 Make the most of your parent newsletters, the Parent Teacher Association (PTA) and text messaging services, if you have them. Let parents know what you have panned and how you'd like them to be involved in advance of the Week (at least a month before). They might be able to collect/donate materials for use during the Week, and if you want them to try any experiments at home, they may need time to plan and collect materials for themselves. The PTA may be able to support you financially to run the Week or help drum up parent volunteers.

2 Get parents thinking about how their own jobs might link to science and technology subjects and encourage them to chat with their children about this. You could do this via a newsletter.

3 Encourage exploring the outdoors in the community or in local cultural spots. This could be anything from local parks to the streets around students' homes. Parents and families can get involved by going on a nature walk, exploring science related events and activities in their local area, or visiting places such as museums or science centres. Many of our CREST activities are quick and easy to do as fun outdoor challenges too: library.crestawards.org

4 If you k now that parents may struggle to engage with British Science Week at home, invite them on school trips or use resources such as: bsa.sc/oxford-sparks

5 Send an experiment idea home during the Week which may spark mealtime discussions around STEM. Try and make it as easy as possible. It can help if it's something the students have tried or seen at school first, so they feel like 'experts' when they do it at home with family, allowing them to lead the learning.

6 You can download lots of other useful take home activities such as: rigb.org/families/experimental

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Gathering resources for your classroom or home

- Try to collect materials all year round: empty bottles, toilet rolls, cereal boxes, elastic bands, newspapers, etc. This way you will have lots of great things to use during your British Science Week.
- Alternatively, check whether there is a scrap shop/store/club in your local area. These shops are often membership-based and can provide a brilliant, inexpensive or free resource for card, plastic, bits of material – all sorts. These things can be turned into rockets, cars, spaceships; you name it, the kids will think of it!
- Look at childrensscrapstore.co.uk to find a UK directory of scrap stores or use Google to find your nearest.
- Look out for the 'At home' tasks in this pack for more ideas.

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Beyond the Week

Once British Science Week is over, it doesn't mean the exploration and curiosity must stop!

Below are some ideas of how you can continue the fun:

- Set up a STEM club or run a Curiosity Lab once a month during science class.
- Students could take part in a CREST Award, spending anywhere between 5 and 70 hours of work on a project that they lead, on a topic they're interested in. For more information, take a look at the different CREST levels available: crestawards.org/which-level
- Older students could run a CREST Star Award with younger students, and work on their communication skills. Learn more about CREST Star here: crestawards.org/crest-star
- Consider sharing your British Science Week learnings by running a CPD session for other teachers in your school or, where relevant, academy chain.
- Think about incorporating the Science Capital teaching approach into your methods: ucl.ac.uk/ioe/departments-and-centres/departments/education-practice-and-society/science-capital-research/science-capital-teaching-approach
- Keep an eye out for the 'Next steps' tasks in this pack for more ideas.

CREST AWARDS

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Get students leading the way

A great way to encourage STEM interest in young people is by letting them lead the way. Here's how you can help them along:

- Encourage young people to run their own events during British Science Week. They could recruit STEM Ambassadors or *Inspiring the Future* volunteers to come in and present in class or at an assembly, or ask classmates' parents with knowledge and experience of any STEM-related subjects to speak about their own backgrounds.
- Young people could research events or programmes happening in your community, particularly those that at first don't seem to be obviously science related. Take a look at some of the community groups we work with during British Science Week for inspiration on where to start: britishscienceweek.org/plan-your-activities/support-us/community-grant-case-studies
- Get students running their own CREST projects and use this as inspiration for a science fair or other related event. We have lots of handy CREST resources on our website: library.crestawards.org

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NATIONAL SPACE ACADEMY

Diverse jobs

Astronaut hovercraft experiments

About this activity

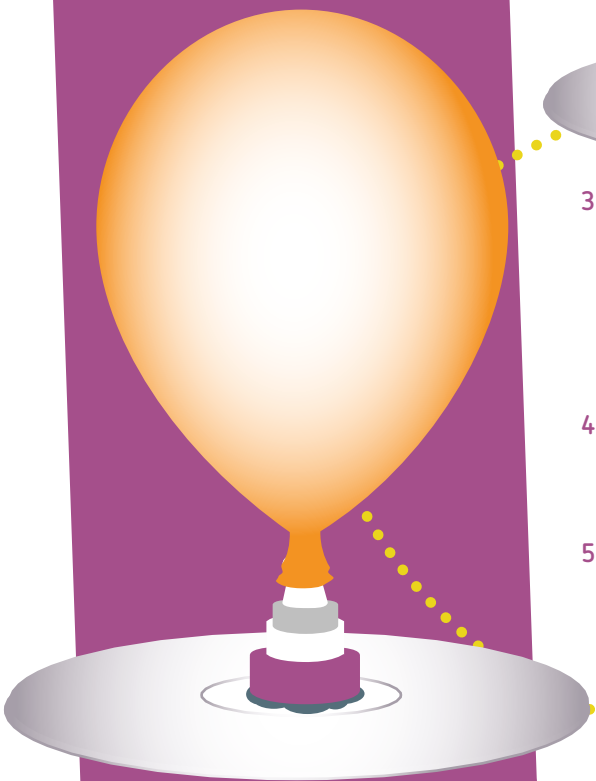
In March 2020 there is a cargo resupply mission to the International Space Station (ISS). The ISS was built by space agencies from countries around the world.

In this activity you'll look at some of the experiments that UK European Space Agency (ESA) astronaut Tim Peake completed onboard the ISS, before you have a go yourself!

Kit list

- 1 x CD
- 1 x pull-up bottle lid (such as on a sports drink)
- 1 x balloon
- 1 x blob of Blu Tack
- Stopwatch or camera (optional)
- 2 x one metre rulers (optional)

Time: 1 hour

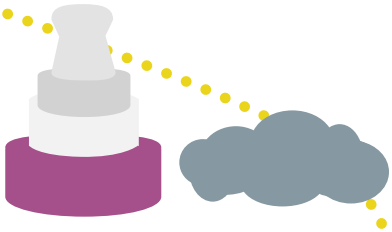


Instructions

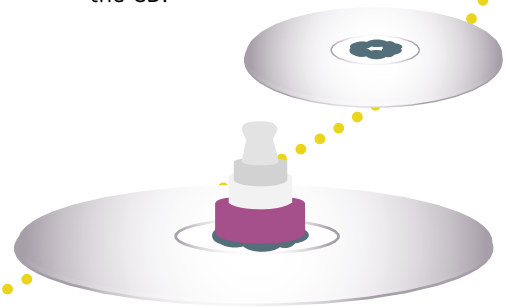
First, head to astroacademy.org.uk/resources/collisions to watch Tim Peake's demonstrations of elastic and inelastic collisions between objects of different masses.

Now it's your turn

1 Roll the Blu Tack into a sausage shape and press it around the edge of the bottom of the bottle lid.



2 Push the bottle top down onto the middle of the CD so that it sticks to the CD with no gaps for the air to escape, except through the hole in the CD.



3 Blow up the balloon reasonably full, but not completely, and then twist the bottom round several times (so the air doesn't come out while you're attaching it to your hovercraft base!)

4 Stretch the balloon over the top of the bottle top with the bottle top closed. Untwist the balloon.

5 When you want your hovercraft to go, pull the bottle lid into the open position. Push your hovercraft gently and watch how far it glides!

6 Just like Tim did in the video, try (gently!) colliding two hovercrafts. What happens and why?

Next steps

- What happens if you increase the mass or velocity of your hovercraft? Can you think of a way to record data from your experiment to show what is happening?
- Download the CAPCOM GO! app by NSC Creative in the app store to see an augmented reality rocket launch.

At home

Visit spotthestation.nasa.gov to see when the ISS will be visible in your area.

We would love to see your hovercraft experiments. Ask your teacher to share them with us.

Twitter UKSpaceAcademy
Instagram spaceacademyuk

To find out more about us visit

nationalspaceacademy.org

By Natalie Tunnicliffe, Physics Teacher at the National Space Academy

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ARMY BE THE BEST

Diverse jobs

Frontline biology

About this activity

Soldiers use a lot of energy as they work, so they need regular meals and snacks to keep going. Many soldiers must work far away from their Army base, so they won't always have time to stop to prepare food. In this activity, you will design them a high-energy snack they can eat 'on the go'.

Context

The Army fulfills many roles in different parts of the world. Following a severe earthquake over 100,000 people are without shelter, food or clean water. In situations like this the British Army gets deployed to provide urgent relief. Soldiers build temporary bridges and shelters. They also distribute emergency blankets, food and water. Time is always of the essence as the soldiers and other Army personnel work around the clock. They need to keep their energy levels high.

Kit list

- ☑ Ingredients from the table on the following page – ideally all of them, or as many as possible.

Time: 1 hour

Watch out!

We do not advise eating the food you have made. If you do you should follow the guidelines in The ASE booklet Be safe! (4th edition), which has a Safety Code for food hygiene.

Instructions

1 Think about what you want your snack to contain, and any other criteria it needs to meet. For example, it should:

- ☑ Contain between 250 and 300 calories.
- ☑ Contain less than 25g of sugar, as this releases energy too quickly and can be bad for soldiers' teeth.

2 Now it's time to design your snack. Use the ingredients on the key facts page to choose what will go into your snack.

3 Make sure you remember to:

- ☑ Calculate how many grams of total sugar and calories your snack will contain.
- ☑ List your ingredients and why you have chosen each one.

Using the table on the next page design your snack.

Use as much or as little as you like of each ingredient e.g. 10g, 20g or 30g

- ☑ Add up the total carbohydrates, sugar and calories your snack will contain.

Next steps

Learn more about the diverse careers the army has to offer:
army.mod.uk/careers

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ARMY BE THE BEST

Work sheet

Now choose your ingredients!

Make sure you consider:

- Which ingredients will go well together to make a tasty snack?
- Which ingredients will make up most of your snack?
- Which ingredients will you include just a little of?
- Choosing at least one bonding ingredient to hold your snack together.

Ingredient	Quantity	Carbohydrates (Starch) Provide energy	Carbohydrates (Sugar) Spike blood sugar and damages teeth	Fat Provides slow release energy	Protein Builds and repairs muscles	Calories total energy provided by food
Oats	10g	7g	0g	1g	1g	40
Whole wheat flakes	10g	8g	2g	0g	1g	35
Brown rice syrup*	10g	8g	8g	0g	0g	50
Honey*	10g	9g	9g	0g	0g	30
Dark chocolate*	10g	5g	2g	4g	1g	60
Milk chocolate*	10g	6g	5g	3g	1g	55
White chocolate*	10g	6g	6g	3g	1g	55
Crisped rice	10g	9g	8g	0g	1g	40
Sultanas	10g	8g	6g	0g	0g	30
Dates	10g	8g	6g	0g	0g	30
Dried apple	10g	7g	6g	0g	0g	25
Coconut	10g	1g	1g	6g	0g	60
Dried berries	10g	8g	7g	0g	0g	30
Peanut butter*	10g	2g	1g	5g	2g	60
Almonds	10g	2g	0g	5g	2g	60
Hazelnuts	10g	2g	0g	6g	1g	60
Mixed seeds	10g	2g	0g	5g	2g	60

* = bonding ingredient

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ROYAL MUSEUMS GREENWICH

Lloyd's Register Foundation

Diverse jobs

Conservation matter(s)

About this activity

Can you protect your favourite objects from the agents of deterioration?

The Prince Philip Maritime Collections Centre (PPMCC) at Royal Museums Greenwich has a diverse collection of historic objects, which need careful storage depending on the material they're made from. In this activity, you will play the role of a conservator and use your creativity and knowledge of specific material types to design ways of preventing irreversible damage.

Kit list

- List of agents of deterioration (found on following page)
- Condition report, downloadable from **rmg.co.uk/see-do/british-science-week**
- A range of everyday items made from materials with different characteristics, including natural and man-made. These could be wood, stone, paper, plastic or metal
- Extension activity – materials to build the protecting casing.

Time: 1 hour

Instructions

1 Working as a pair, select three items from those provided. Make sure each item is made from a different material.

2 Investigate each object using the condition report via the link in the Kit List. Follow the questions of the report to identify the object's condition. Notice how the material of each item has different characteristics.

3 As a conservator, your aim is to protect your items from deterioration. Read the list of common types of deterioration and discuss with your partner. List on your report the deteriorations you think your items are most susceptible to.

4 Now you have identified the agents of deterioration, you need to think about how you are going to prevent them damaging your objects. You will notice that some materials are more vulnerable to multiple types of deterioration than others. To prevent further damage, you must design a container for each object that will reduce any risk to the item - whether it's pests, temperature, light, humidity and/or humans.

5 Present your design to your classmates. When making the presentation, ensure that you back up your choices and designs with scientific knowledge. Present reasoned explanations, including explaining the data behind your predictions of how your object may be damaged when exposed to different types of deterioration.

For example:
This comic book is susceptible to light damage. The evidence shows this because the exposed front page is lighter than the pages on the inside, which are usually hidden from light; therefore, my container will be made from U.V protective glass.

6 How are the needs of each of your three items different?

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Supporting Information

Agents of deterioration

ROYAL MUSEUMS GREENWICH

Lloyd's Register Foundation

Objects can be damaged in many ways. Here are some examples you may wish to consider when thinking of how to protect your objects. Can you think of any other examples?

Human action

Often objects become damaged through misuse or not being stored properly. Physical force can damage artefacts directly by causing stress, breakage and pressure. This could be due to stacking objects on top of each other or accidentally knocking into an item. Staff at Royal Museums Greenwich prevent physical force damage by storing artefacts in cases or in cabinets. The most common cause of damage by humans is over-cleaning. Vandalism or theft are also a concern, especially for objects in public areas.

Light

Light damage can be caused by overexposure to either natural or artificial light. Light has the biggest effect on paper-based objects, and in the case of letters or manuscripts, can result in the object becoming unreadable. It's a shame if artefacts fade from exposure to excessive light, as it makes it harder to see what the artefact originally looked like. Staff at Royal Museums Greenwich try to minimise the amount of times light sensitive objects are exposed to light by rotating them from display and storing them in dark cabinets or containers.

Fire

Fire can cause smoke damage, or partial or total loss of the artefacts. As a result, it is important that fire prevention be given the highest priority possible. Staff at Royal Museums Greenwich use secondary housing to protect the objects from fires. Secondary housing means putting a container within another container to create an extra barrier.

Water

Water damage can result from natural occurrences, human intervention or plumbing failures. The museum stores its collection off the floor and inside cabinets, in anticipation of a leak or flood.

Pests

Pests such as insects and rodents can sometimes see the valuable collection as a nice snack rather than artefact. They are attracted to objects made from natural materials, such as plants and animals.

Before adding new objects into the collection, staff at Royal Museums Greenwich place all our organic items into quarantine. In quarantine the new objects are frozen which eradicates any potential pests and their eggs. All objects from natural based materials are then stored in containers which prevent aces of pests

Pollutants

Pollutants can be natural or man-made gases, aerosols, liquids, dust or dirt that are known to accelerate decay of the objects. Aerosols and liquids that are commonly seen around artefacts are household cleaners, bug sprays, and detergents. The chemicals within these sprays can attach to the objects and slowly cause it to decay.

Temperature and humidity

Incorrect temperatures and humidity can damage the objects. Depending on the material of the object, it can react in different ways to extremes of temperature and humidity. Warm and damp conditions may result in mould.

BRITISH SCIENCE WEEK

Diverse jobs

Design an Antarctic research station

UK ANTARCTIC HERITAGE TRUST
ANTARCTICA IN SIGHT

About this activity

Antarctica was first sighted 200 years ago. The early explorers were looking for new sources of seals and whales to exploit for their pelts and oil. In the last 100 years, through international science programmes, we now understand that Antarctica is pivotal in the Earth's climate system and a sensitive barometer of environmental change. In this activity, you will investigate the geopolitics of Antarctica and design a science station suitable for scientific research in Antarctica.

Background

There are few places on Earth where there has never been war, where the environment is fully protected, and where scientific research has priority. In 1959, the governing Antarctic Treaty, which unites over 50 nations, made Antarctica a continent dedicated to scientific research with a common aim: to encourage international cooperation and protect the environment for future generations.

Kit list

- Access to a computer or fact sheets on Antarctica
- Coloured pens
- A3 paper (for design)

Time: 2+ hours

Instructions

1. Start by doing some research on past and present buildings in Antarctica - what was their purpose and how were the stations are designed?

2. Think about the key scientific knowledge you will need for designing your station. For example:
   - What is the terrain like? Where would you locate it?
   - How cold can it get in Antarctica?
   - What temperature will it need to be inside the station? How will you heat the station? How will you maintain the temperature? Think about thermal energy and insulation.
   - What will the inhabitants be doing there? What equipment and rooms will the station need to accommodate them?

3. Consider what research will be completed in the station – look at the priorities of the countries involved in the Antarctic Treaty and the similarities/ differences between them. The station will need to be equipped for these kinds of research.

4. Consider what other elements might need to be included:
   - How will you reach your station?
   - Will researchers live in the station or will they have a separate building to stay in?
   - How and where will they eat, sleep, exercise etc?
   - How will researchers travel around?
   - How can you make the research station representative of all the nations involved?

5. Make a design for the station, incorporating everything you have considered above. How will you communicate your ideas?

6. You may also wish to consider how materials will be transported to the Antarctic to build your station.

Next steps

Use these links to research your survey station.

ukaht.org/discover/port-lockroy

ukaht.org/discover/other-historic-sites

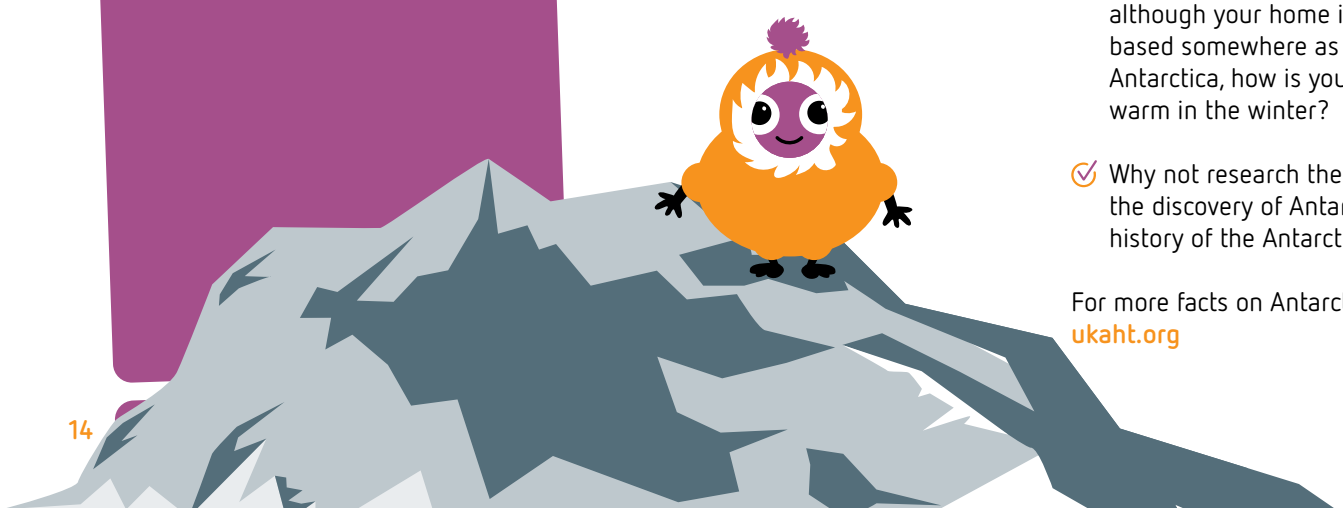
bas.ac.uk/polar-operations/sites-and-facilities/station

discoveringantarctica.org.uk/how-is-antarctica-governed/geopolitics/geopolitics-of-antarctica/

At home

- Look for examples of the knowledge you have from your everyday life. For example, although your home is likely not based somewhere as cold as Antarctica, how is your home kept warm in the winter?
- Why not research the history of the discovery of Antarctica, or the history of the Antarctic Treaty?

For more facts on Antarctica visit ukaht.org



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UK ANTARCTIC HERITAGE TRUST

ANTARCTICA IN SIGHT

Fact sheet

Antarctica facts

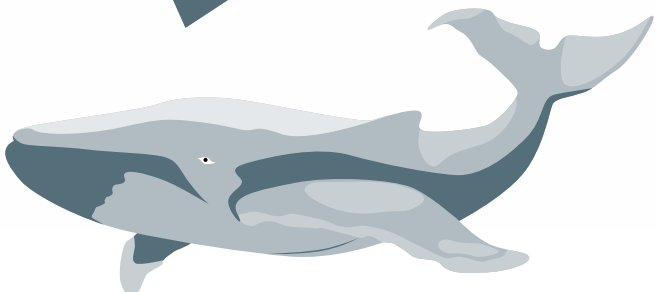
Since its discovery, Antarctica has had a chequered past. Once news of this new land was known, global exploitation of its abundant seal population began almost immediately; later it was whalers that would exploit the environment.

During the 20th century, the focus of human activity in Antarctica shifted to a new form of exploration, as scientists began to study the continent's environment and biodiversity and steps were taken to protect them. Today, scientific research in Antarctica shapes how we see and understand our world.

The Antarctic Treaty was set up in 1959 by 12 nations. Now, more than 50 countries have signed up to this unique set of principles.

Legal protocols have since strengthened the protection of the environment, forbidding mineral and oil exploration, controlling human activity in Antarctica.

Whilst the treaty does not have an expiry date, in 2048 any country can call for a conference to renegotiate the terms of its environmental protection.



BRITISH SCIENCE WEEK

Diverse people

Revealing fingerprints

About this activity

Every person's body is different, and this includes our fingerprints. This means they are very useful in identifying people, in particular those who have left fingerprints at a crime scene. In this activity you will investigate the best way to identify fingerprints on different surfaces.

Kit list

- Different surfaces to retrieve fingerprints from. e.g. crockery, glass, paper, gloss paint
- Ink pad
- Different types of adhesive tape, to test their effectiveness at lifting prints
- 'Dust' to use for lifting prints. e.g. cocoa powder
- Iodine vapour can also be used to reveal latent fingerprints. You could try this, but be careful what you expose to iodine – it may permanently stain some surfaces.

Time: 2+ hour

Watch out!

Iodine is **HARMFUL - avoid skin contact.**

Some powders and chemicals used to reveal fingerprints may be hazardous. Make sure you complete a risk assessment before you start your investigation and check it with your teacher.

Instructions

1 Start by testing how well you can see your own or others' fingerprints on the different surfaces listed in the kit list.

- Why do you think police take fingerprints from paper, not glass?
- Do fingerprints show up better on light or dark surfaces?
- Are prints more difficult to see clearly on a patterned surface?
- Does the answer depend on whether the fingers are clean or dirty? For example, with mud, oil / grease or printing ink after reading a newspaper.

2 If revealing fingerprints involves using chemicals, you may need to remove the print from the surface first, to avoid the chemicals damaging the surface. This is called 'lifting'.

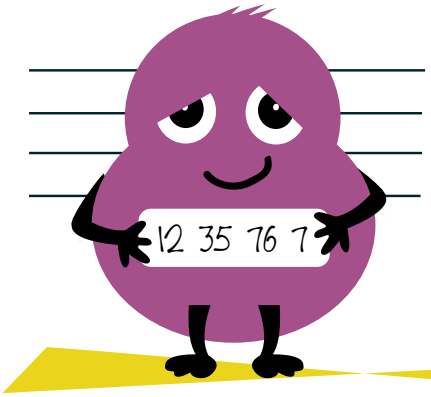
- You can 'lift' fingerprints using adhesive tape such as sellotape. Why not try different adhesive tapes to see which one is best for 'lifting' fingerprints.
- If revealing fingerprints involves using chemicals, you may need to remove the print from the surface first, to avoid the chemicals damaging the surface. This is called 'lifting'.
- You could investigate various types of adhesive tape to see which picks up the best impression of the fingerprint from different types of surface. You may need to find a way to 'develop' the print on the sticky surface to make it more visible.

3 Argue your case:

- Why not use your discoveries about identifying fingerprints to argue a case, identifying some fingerprints at a fictional crime scene?
- You will need some sample latent prints, and a record of prints from a suspected 'criminal'. Use your identification skills to argue that the 'suspect' was in fact at the scene of the crime.

Next steps

This activity can be put towards a CREST Bronze Award. For more information, follow this link: crestawards.org/crest-bronze



BRITISH SCIENCE WEEK

wellcome centre human genetics

Diverse people

Darn it! Find the damage in your DNA

About this activity

Your DNA is constantly being damaged, but your cells are always looking for this damage in order to fix it. Dig through this bag of 'wool DNA' to find the damaged sites as quickly as you can.

Kit list

- 46 small balls of wool (23 sets of coloured pairs, if possible, but not essential)
- Five types of small items that can be tied to the wool, to indicate the different kinds of DNA damage. For example:
  - Thin ribbon – 'methylated sites'
  - Plain beads – 'abasic sites'
  - Letter shaped beads – 'oxidative damage'
  - Small craft pegs – 'pyrimidine dimers'
  - Hook and loops – 'double strand breaks'
- Masking tape
- A big-ish (1m diameter) bag that can fit all the wool (a bin liner would work, or netting bag)

Advance activity for teachers

- Each ball of wool is a chromosome and the wool itself is the DNA. Unwrap the balls of wool and pull them apart.
- Wrap the last few centimetres of each ball of wool in masking tape. This marks a 'telomere', the end of a chromosome (not a type of DNA damage)
- As you pull apart each ball of wool, tie in one or two of the 'DNA damage' items – a small piece of ribbon, or a bead, for example. This will distribute different kinds of 'DNA damage' throughout.
- The double strand break 'DNA damage' should be very rare. These are a more harmful, but less common, form of damage, so only use two – make a single cut in two of the balls of 'wool DNA', then attach an eye to one of the cut ends and a hook to the other.
- Put all your wool in a large bag – the bag is the nucleus of your 'cell'. Mix the wool around.

Instructions for students

1. Get ready to find as much 'DNA damage' as you can! Dig through the 'nucleus' of the cell to find any ribbons, beads, pegs, or either of the two sets of hook and loops. Set a timer for one minute.
2. When you find a piece of damage, quickly hold it up for it to be counted and then drop it back into the nucleus – no need to hold onto them.
3. Remember, masking-tape are telomeres – the end of a chromosome – and don't count as damage
4. How much damage, and of what types, did you manage to find in one minute? Who was able to find the most? Did anyone manage to find the double strand breaks? You would need to find BOTH ends to repair them properly!
5. Your cells have mechanisms to do what you just did – find the damage so it can be fixed. Can you work out how quickly your actual cells would find the number of errors you were able to find in one minute, given each cell needs to find *one million* damaged sites every 24 hours?

Did you know?

- If you scaled a cell up so that the DNA was as wide as wool (2mm), you would need two million metres of wool to make up this kit, and the nucleus would be 10 metres in diameter.
- If you weighed just the DNA in your body, it would come to around 100 grams – about the weight of a hamster!

Next steps

Visit the links below to learn more about this topic:

well.ox.ac.uk/green
nature.com/scitable/topicpage/dna-damage-repair-mechanisms-for-maintaining-dna-344/

BRITISH SCIENCE WEEK

BBC Teach

Diverse people

What kind of taster are you?

About this activity

Are you a supertaster? Supertasters experience bitter tastes more strongly than other people; this is because they have a higher number of taste receptors within the 'fungiform papillae'. These are the big pink bumps on your tongue that contain your taste buds and enable you to taste. In this activity, you will determine whether you are a supertaster, taster or non-taster.

Advance teacher activity

- Cut the A4 card in to 16 strips and punch a hole in the end of each strip. Ensure you have enough for each child to have their own strip.
- Split class into groups of three.
- Pour a little food dye into the mini cups so that each group has one cup each.

Kit list

- Bottle of natural blue food dye
- Cotton buds
- Disposable 'mini cups'
- A4 card
- Hole punch
- Scissors
- Torches (optional)
- Magnifying glass (optional)
- Damp cloth
- Cup or bag on each table for waste
- Anti-bacterial surface cleaner

Time: 1 hour

Watch out!
See page 19 for details.

Instructions

1 Everyone taking part should wash their hands.

2 Take a look at the 'Glossary' at the end of this activity, to make sure you understand what all the words mean.

3 The person who is going to have their fungiform papillae (pink bumps) counted first needs to sit down with their elbows on the table, supporting their chin.

4 Place a cotton bud into the blue food dye until it is covered. Ask the person taking part to stick their tongue out. Using the cotton bud, coat the front third of the person's tongue with the dye.

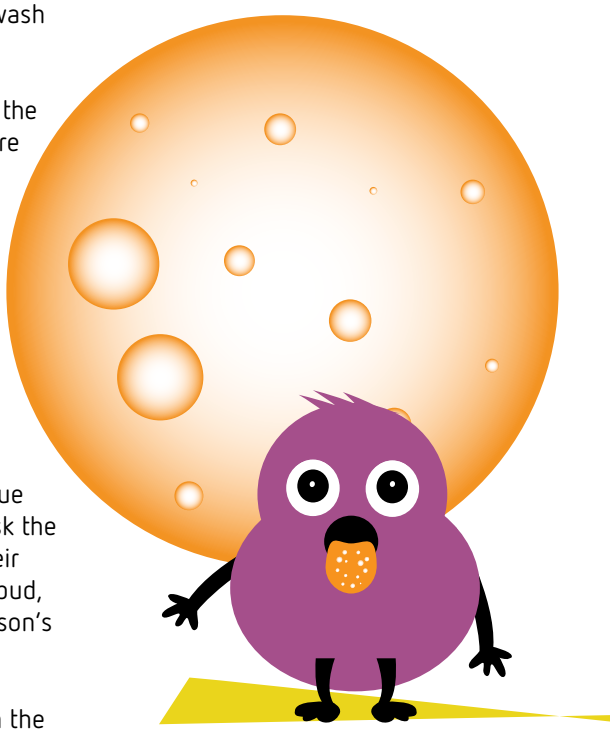
NB: Only dip the cotton bud in the food dye once. Place the cotton bud in a container such as a plastic bag which will then be thrown away.

5 The blue dye will stain the tongue but slide off the fungiform papillae. Did you know, each bump contains three to five taste buds!

6 Next, ask the person to carefully place a hole-punched card on their tongue over the blue food dye.

7 Looking through the hole in the strip of paper, someone in your group should count how many pink bumps they can see on the tongue inside the hole.

8 Count the number of fungiform papillae twice to find an average amount. Record your results on the student sheet. (See page 19) When you have finished with the card, throw it away like you did with the cotton bud.



The results

9 Look at the chart at the end of this activity and see how your classmates' sense of taste compare to the rest of the nation! Use the chart on page 19 to collate your class results.

10 What percentage of your class fits into each category?

11 Does your class follow the national distribution for each category?

12 Did you observe a pattern between the number and density of fungiform papillae?

Next steps

Find more exciting activities by visiting bbc.co.uk/teach/terrific-scientific

At home

Why not try this activity at home, with family or friends? You could see how their results compare to your classmates.

BRITISH SCIENCE WEEK

Pupil worksheet:
super taste test results

BBC Teach

What kind of taster are you?

Watch out!
Ensure the person preparing and handing out the holed card has clean hands, uses new card and has clean scissors and hole-punch. Prepared card should be kept in a new freezer bag or similar.

Used cotton buds and card strips should be discarded into a waste container immediately after use and the container then placed in refuse.

Ensure all pupils wash their hands before and after taking part in the activity. Only allow children to dip their cotton bud once into the food dye. If more dye is needed, get a fresh cotton bud. Have a receptacle on each table for waste.

Have paper towels on hand to clean up any mess or spillages.

Have on hand anti-bacterial surface cleaner or wipes.

Make sure pupils know that there is nothing wrong with being any of the different kinds of taster.

First name	Number of fungiform papillae (pink bumps)	What kind of taster are you? a. Non-taster b. Taster c. Supertaster

Class super taste test results

Please collate the number of non-tasters, tasters and supertasters in your class.

Type of taster	Number in our class
Non-tasters	
Tasters	
Supertasters	

How to interpret results

Use this table to work out if your results show that you are a non-taster, taster or supertaster.

Number of fungiform papillae (pink bumps)	Type of taster	How common in population
0 -5	Non-taster	One in four (25%)
6 - 10	Taster	One in two (50%)
11 +	Supertaster	One in four (25%)

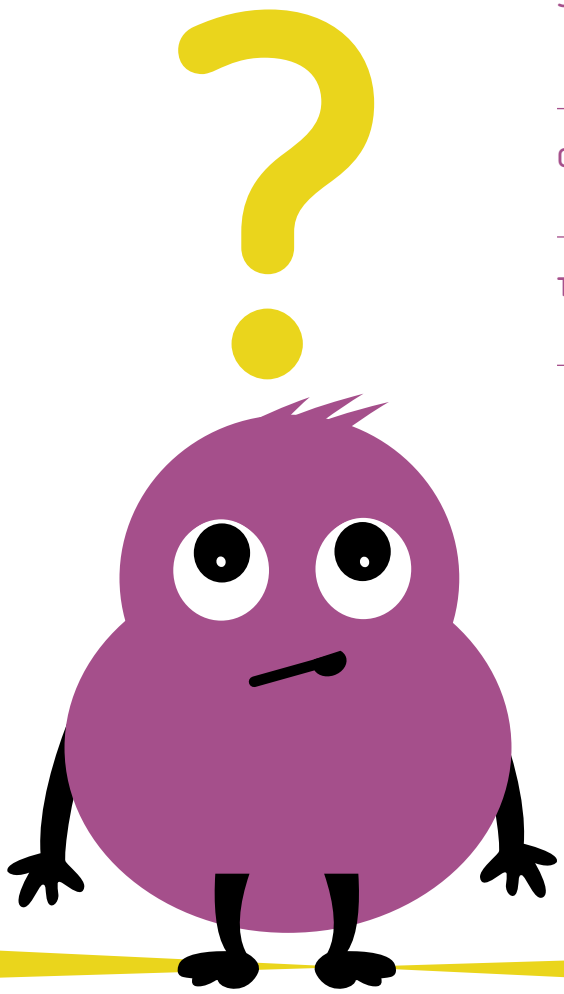
BRITISH SCIENCE WEEK

BBC Teach

Glossary

What kind of taster are you?

Fungiform papillae	Scientific name for the big, round pink bumps on the tongue which contain taste buds.
Taster chart	A chart used to indicate whether a person is a supertaster or not.
Non-tasters	A percentage of the population that has fewer fungiform papillae (pink bumps) on their tongues than most and are less sensitive to bitter tastes.
Tasters	A percentage of the population that has an average amount of fungiform papillae (pink bumps) on their tongues.
Supertasters	A percentage of the population that has more fungiform papillae (pink bumps) on their tongues than most and are more sensitive to bitter tastes.
Cotton bud	A small wad of cotton wrapped around one or both ends of a short rod.
Taste	Sense which helps us experience salt, sweet, sour, bitter and umami flavours with our tongues.



BRITISH SCIENCE WEEK

nsead

Diverse people

Peg and pen drawing

About this activity

All good STEM practice requires collaboration; the ability to work with others effectively, even when you may not necessarily see eye to eye. This fun exercise gets four people holding the same drawing pen with pegs, then asks them to draw a STEM themed image collaboratively. Will your drawing descend into chaos or will your diverse characters learn to work effectively together?

Kit list

- Four spring clothes pegs
- Felt tip pen
- Large A1 size paper - divided into nine equal squares
- Suitable photograph to copy - divided into 9 equal squares
- Masking tape

Time: 15-20 minutes

Watch out!

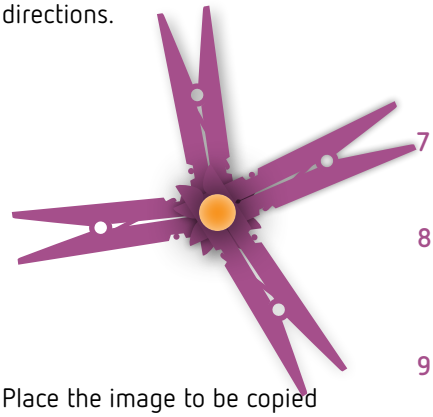
Be careful of getting felt tip on clothes.

This exercise was adapted from the book *Drawing for Science Invention & Discovery* by Paul Carney. paulcarneyarts.com

Instructions

1 Fix the piece of A1 paper to a desk.

2 Attach four clothes pegs to the felt pen so they face different directions.



3 Place the image to be copied (flowers and animals are good for this) near the A1 paper.

4 Get four people to stand around the paper, each holding their own clothes peg.

5 No talking is allowed at this stage – ask them to place their non-drawing hands over their mouth!

6 Now, try to copy the photo accurately using the squares to guide you - you're allowed 5 minutes to complete the task.

7 Evaluate the exercise. Was it difficult? If so why?

8 Now repeat the exercise (with a different photo if you prefer). This time you can speak to each other.

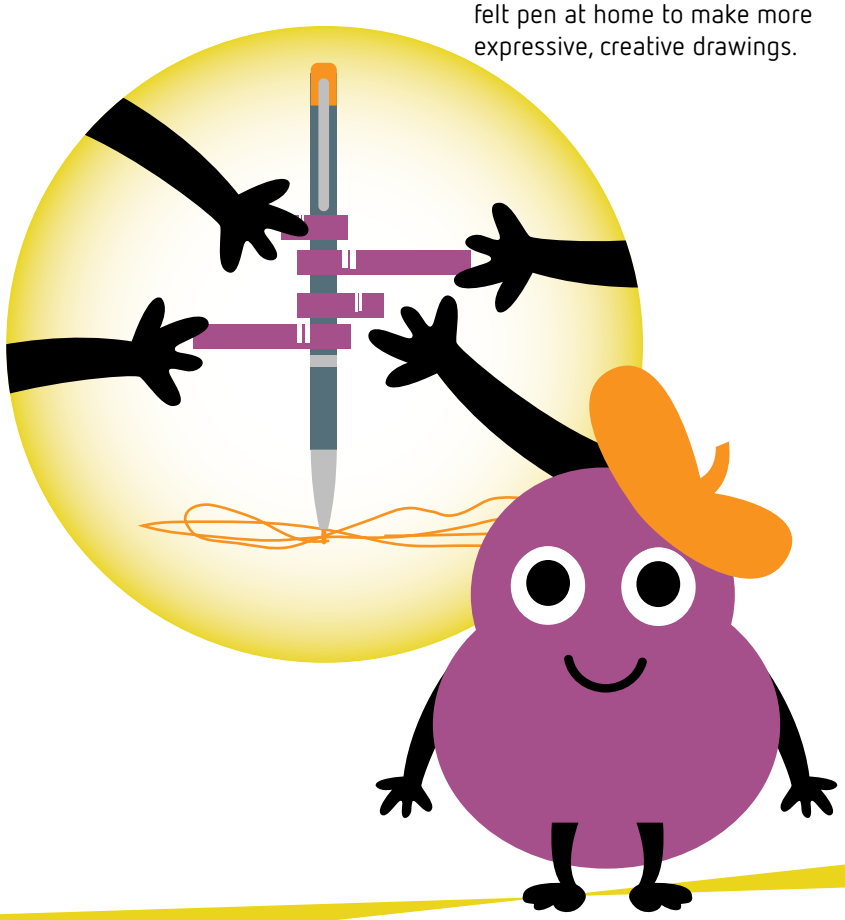
9 Evaluation: how does effective communication affect our ability to do this task better?

Next steps

For more resources visit nsead.org

At home

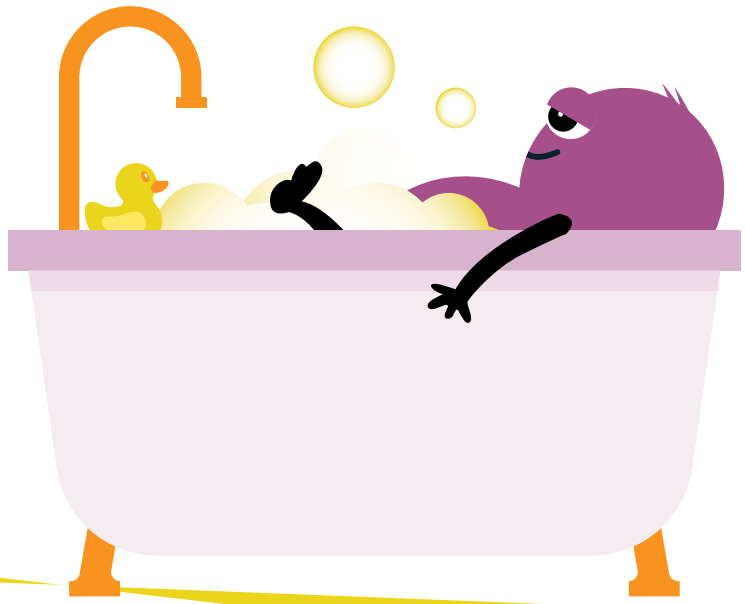
Practice drawing with a peg and felt pen at home to make more expressive, creative drawings.



BRITISH SCIENCE WEEK

Try it at home

Make your own bath bomb



About this activity

In this activity you will investigate how to make your own bath bomb. We can all support the diversity of our planet by using less packaging including single-use materials. By designing your own bath bomb you could also find a way to cut down on the packaging required and encourage others to make their own bath bombs.

The following recipe makes four small bath bombs.

Dry ingredients

- 100 grams baking soda
- 50 grams citric acid
- 25 grams cornflour

Wet ingredients

- 2 tbsp sunflower oil or olive oil
- 2 tsp water
- 1 tsp food colouring (optional)
- 12-15 drops essential oils of choice (be sure to check for allergies)

Kit list

- Two mixing bowls
- Whisk
- Flexible plastic moulds (clean empty yogurt pots, silicone ice cube tray or silicone cupcake cases)

Time: 2+ hours

Watch out!

Always complete a risk assessment and have it checked by your teacher before you start your experiment.

Never use anything on your skin that has been made in the laboratory or using laboratory chemicals.

Instructions

1. Mix the dry ingredients together in one bowl and the wet ingredients together in the other bowl.
2. Add the wet ingredients to the dry ingredients a few drops at a time while whisking, until the mixture just sticks together when pressed.
3. Press the mixture into the mould and leave to dry for at least 2 hours.
4. Make a few bath bombs with variations and record the differences in them, such as:
   - More or less baking soda
   - More or less citric acid
   - Different oils (citric or other)
   - Different colours
5. Remember to keep some elements the same, to make it a fair test.
6. Now it's time to test your bath bomb! Put the bath bomb in some water and record:
   - How long it takes to disperse.
   - How high the 'fizz' is.
   - What happens to the water.
   - Anything else you think might be important in deciding if a bath bomb is effective or not.
7. Compare your different bath bombs, deciding which one makes it more effective as a bath bomb.
8. Re-write your favourite recipe as a step-by-step guide

Next steps

This activity can be put towards a CREST Bronze Award. For more information, follow this link: crestawards.org/crest-bronze

ClairCity received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 689289.

BRITISH SCIENCE WEEK

Preserving natural diversity

Pollution solution

About this activity

One in eight deaths are due to air pollution - and yet human and planetary health are not at the heart of political decision-making. In this Top Trumps-style game, you will hold your own 'citizens assembly' to explore the trade-offs that we consider when making decisions about our health and that of the environment. You will learn the science of air pollution and carbon emissions, discover the solutions that exist and vote for what you want to prioritise and work on to improve air quality in our towns and cities.

Kit list

- Top Trumps cards (complete) - via link below
- Top Trumps template sheet (one for each pair) - accessible via link below
- Top Trumps template document (to be filled out during class) - accessible via link below
- Flipchart paper and pen
- Sticky dots

Time: 1 hour

Advance activity for teachers

- On a piece of flipchart, draw a table with symbols (or numbers) to represent each Top Trump in columns
- The full lesson plan is available here: sustainablelearning.com/resource/air-pollution-citizens-assembly
- Start the activity by brainstorming the causes/sources of air pollution and fill in one of the Top Trumps cards together, to make sure everyone understands the game.
- Later on, hand out the complete packs of Top Trumps cards **(see step 4).**

Instructions

1 In pairs, discuss a few solutions to the air pollution problem.

- What could we change?
- What could we build?
- What could we teach?

2 In pairs, fill in a Top Trumps card. Using an example of supermarkets delivering food by bike, you might ask:

- How **difficult** is it for supermarkets to do this?
- How **expensive** would it be to implement?
- Would it affect delivery **speed**?
- Would it cause **environmental** harm?

3 Follow step 2 for three more cards, based around the theme of transport.

4 Your teacher should then hand out the completed packs to you in your pairs. Add these complete packs to the four newly created cards.

5 Play the game. If you lose all your cards, and there is time, play again. Once you have played, think about what your favourite choice was.

6 Each pair should vote for their favourite, by sticking a dot on your preferred option.

7 You should then discuss trade-offs for the winning solution as a class:

- What would you have to give up?
- What would you gain?
- Is there a perfect solution for everyone?

Next steps

Explore these ideas further by playing ClairCity Skylines (a sort of digital Top Trumps): claircity.eu/take-action/game

Develop an action plan for implementing the change. This could include:

- Get involved in Eco Schools and form an Eco Committee: eco-schools.org.uk
- Start a campaign at your school to address air pollution locally.
- Make a poster about air pollution and what teachers and students can do to reduce it.
- Host an event with invited speakers to inform teachers, parents and pupils.
- Write a persuasive letter to a polluting business to change their practices.
- Write a persuasive letter to your MP – use ClairCity's letter template here: claircity.eu/take-action/schools
- Check out the UK Student Climate Network ukscn.org

BRITISH SCIENCE WEEK

Preserving natural diversity

Collins

Would you want to live next door to a wolf?

About this activity

In this activity you will use food webs, pyramids of numbers and ecosystems to consider whether wolves should be reintroduced into the Scottish Highlands and make arguments for and against.

Background

A proposal has been made to reintroduce wolves into part of the Scottish Highlands. Hundreds of years ago wolves were native to the highlands, and would serve a useful function in that they would control the negative effects of the red deer population which graze areas heavily and can strip land of vegetation.

However, wolves are versatile predators and are also capable of taking sheep and cows, so many farmers oppose this. A possible solution is to contain the wolves by electric fencing but this comes with its own risks.

Kit list

- Printed cards (on next page)
- (Optional) squared paper for pyramid of numbers activity

Time: 2 hours

Instructions

Food webs

1 Use the cards on the next page to construct a food web showing the predator prey relationships between these organisms.

2 Use the purple cards to show the relationships. There are a couple of blank cards to add other organisms.

3 Add the orange cards and see how they fit in.

4 Add the dark grey card and see how this fits in.

5 Explain what it means to say that the wolf is a top predator.

6 Suggest what might happen if the numbers of red deer fall.

Pyramids of numbers

1 A grey wolf needs to eat an average of 3kg of meat per day. A red deer probably has about 25kg of meat on it, whereas a rabbit has around 2kg. Both the deer and the rabbit eat grass.

2 Sketch the pyramid of numbers for the food chain:
wolf – deer – grass
wolf – rabbit – grass

3 Explain why these pyramids are very different shapes.

Managing ecosystems

1 Red deer tend to stay in one area and over-graze it.

- Suggest how they would be affected by the introduction of wolves.
- The presence of red deer supports hunting and shooting, which generates revenue. Suggest whether this is a good reason to support the reintroduction of wolves.

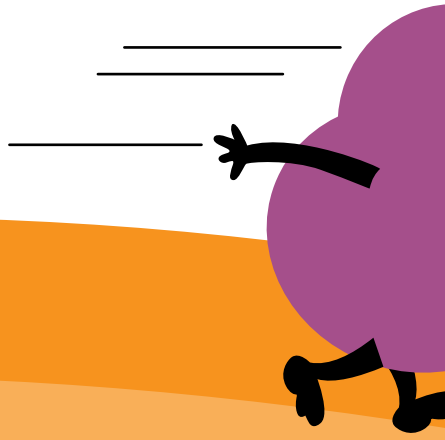
2 Research rewilding. Suggest whether people who support rewilding would agree with the reintroduction of wolves.

Now write a summary

- State whether or not you think that wolves should be reintroduced.
- Include evidence to support your judgment.
- Make it clear how this supports your ideas.

At home

You may well be aware of animals that live in your area. Depending on where you live this might include foxes, gulls or badgers. Can you suggest a wild animal that you don't see around that you think people would be happy to see introduced (or reintroduced) into your locality? Suggest why it would fit in well.



BRITISH SCIENCE WEEK

Collins

Preserving natural diversity

Food web cards

Wolf	Red deer	Vole	Frogs	Cow
Pine Marten	Hare	Birds (including as eggs)	Worms	Sheep
Rabbit	Beaver	Fungi	Heather	
Fox	Grass	Fruit	Trees	

BRITISH SCIENCE WEEK

Discovery EDUCATION | STEM CONNECT

Preserving natural diversity

Food of the future

About this activity

Our planet provides us with an incredible variety of food, but modern farming methods are starting to threaten biodiversity. Learn more about the impact of farming on ecosystems and research what food might look like in the future. This activity assumes prior knowledge of food webs and the interdependence of organisms within an ecosystem.

Kit list

- Computer or other digital device for independent research
- Food Top Trumps worksheet
- Future foods factfile

Time: 2+ hours

Instructions

1 Modern farming relies on clearing large areas of land of their original vegetation, and encouraging the growth of resilient, high-yield crops by using fertilisers and pesticides. Research the following questions and display your results in appropriate graphs/charts for the type of data you have:

- How many hectares of rainforest have been cleared each year over the last 20 years to make way for cattle farming?
- What percentage of the UK land is devoted to farming 'monocultures'? How has this changed over time?
- How many tonnes of pesticides or insecticides are used each year in the UK? And in other countries around the world?

2 Drawing on your knowledge of food webs, interdependence and ecosystems, write a hypothesis for the impact that each of these farming practices might have on biodiversity. Justify your reasoning.

- Clearing land.
- Use of fertilisers.
- Use of pesticides.
- Farming 'monocultures'.

3 Research vegan meat, lab-grown meat, insects, fungi and algae and find out:

- How much processing (and therefore energy) is required to produce them
- How nutritious they are, e.g. how much fat, protein and carbohydrate they contain

If you have STEM connect, you could find this information in the Future foods factfile.

Compare these to other food stuffs by adding the information to the Food top trumps worksheet overleaf. Consider the impact each ingredient would have on biodiversity given how it is produced.

4 Create a menu which helps to support biodiversity using the most nutritious and environmentally friendly ingredients you can. Include graphics and information to illustrate to customers that the food is sustainable and environmentally friendly.

Next steps

Why not sign up for Discovery Education's STEM Connect to access lots more resources?

You can watch the video and find out about sustainable food sources in the Foods of the future unit on STEM Connect

Use the resources on STEM Connect to support you in growing your own small-scale algae farm as part of a 'sustainable food of the future' project.

At home

Have a go at growing some algae or other sustainable and nutritious crop. Bonus points for incorporating it into a dish for your family!

BRITISH SCIENCE WEEK

Discovery EDUCATION | STEM CONNECT

Preserving natural diversity worksheet

Food top trumps

Name Date

Vegan 'meat' (100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Lab grown meat (100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Algae (spirulina, 100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Fungi (mushroom, 100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Insects (crickets, 100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Beef (burger, 100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Pork (sausage, 100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Chicken (breast, 100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

Fish (cod fillet, 100g)

Protein (g)

Calories (kcal)

Fats (g)

Iron (mg)

Calcium (mg)

How much processing (energy) it requires

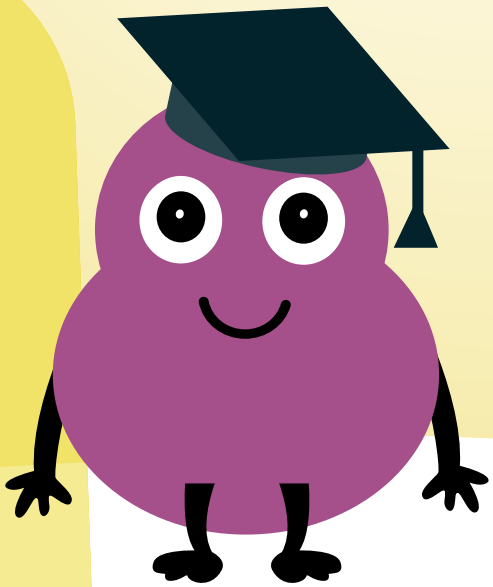
Assembly ideas

Why not start British Science Week off with a bang by holding an assembly to get your students excited about the Week ahead? Tell the British Science Association about your assembly ideas by tweeting or sharing images with the hashtag #BSW20

- Kick start an assembly with a simple but impressive demo. Make a cloud in a bottle britishscienceweek.org/cloud-in-a-bottle
- Remember, a demo is a good way to get young people's attention, but it shouldn't be the whole focus of the assembly. If you can, why not have a student lead the experiment instead of a teacher?
- You could reflect on important scientific discoveries or inventions in the last century, with a special focus on the diversity and range of subjects and the people who discovered or invented them. Try focusing on people from underrepresented backgrounds, whose work may have been overshadowed at the time. See if there is anyone from your area who fits this bill.
- Get the students thinking about how diversity is a part of people, materials, animals, nature or anything else in their everyday lives.
- Profile a specific person who has contributed in some way to the diversity of a STEM field; from opening doors for underrepresented communities, to contributing new ideas, understanding or knowledge.
- Invite a special guest or someone from the school community to come talk about a related topic. See page 4 for information on how to get volunteers.

Here are some other ideas to include during your assembly:

- Tell your students about the plan for British Science Week and give them a challenge related to the theme. If you are sending home a family experiment, maybe you could introduce/demo it during the assembly.
- Where has the topic of diversity been in the news? Is there any way you can discuss this in an assembly?
- Launch the poster competition (see page 29 of this pack).



BRITISH SCIENCE WEEK

Our diverse planet

Poster competition

About this activity

Get creative and enter the British Science Association's annual poster competition. You can make your poster about whatever version of 'Our diverse planet' you like and enter our UK-wide competition with the chance to win an array of prizes.

Kit list

- Paper (A4 or A3)
- Creative materials e.g. pens, pencils, scissors, glue, watercolours, paint, colouring crayons, pipe cleaners, felt, thread, wool, foil, clay, string, beads, stamps, foam, pompoms

  N.B. try to avoid using straws or glitter - these plastics can damage our planet and harm the diverse creatures and ecosystem that live there

Research your poster

Investigate and imagine 'Our diverse planet' and everything that makes it special. Here are some topic ideas to get you started:

- Why not think about biodiversity? From the diversity in your own garden, to the diversity at the very bottom of the ocean, research all the amazing creatures and organisms that live on our planet.
- The diversity of science and STEM subjects. Have a think about all the diverse ways that science affects our lives and who you know that uses science every day. Is there science in baking and cooking? What about making a film or taking a picture? Or how about operating planes and cars? Remember that science is everywhere, you just have to look for it!
- Think about the other kinds of diversity our planet contains – from the variety of the molecules that make up essential parts of life, to the different way our towns and cities are built, and the variation of people's tastes and interests.
- Our planet is unique, but why not investigate what makes it different from the other planets in our solar system?

Make your poster

Once you've done your research, it's time to get creative! Your poster must be:

- 2D (flat) – if you make a model, you need to just send us a photo of it on A4 or A3 paper.
- You can use pop up pictures, pull out tabs or materials such as paint, drawing pencils, crayons and paper.

Send us your poster

Posters will be judged on creativity, how well they fit the theme and how well the poster has been made or drawn.

Once the poster is complete, write your student information on the back, fill in the online registration form, and then post your entry to us at:
British Science Week Poster Competition, British Science Association, 165 Queens Gate, London, SW7 5HD

Next steps

Celebrate! For more details, along with the full set of rules and tips for educators, check out our website britishscienceweek.org/plan-your-activities/poster-competition