BRITISH SCIENCE WEEK 2017

SECONDARY RESOURCE PACK

British Science Week
10 - 19 March 2017
www.britishscienceweek.org

ACTIVITY PACK

This resource pack aims to be your 'one-stop-shop' for supporting you during British Science Week (BSW), but can be used at any time of year. 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 the Week:

British Science Week events
You can either create your own club, class or school event or search for things happening near you on our website. Last year, there were over 5,000 events reaching more than 1 million people. Help us make British Science Week 2017 even bigger and better!
britishscienceweek.org

CREST Awards
Many of the activities can count towards CREST Awards. Further CREST resources can be downloaded for free from **crestawards.org**

The British Science Week 2017 digital badges
All the activities in this pack, as well as attending events/entering the poster competition, can enable you and your students to achieve special British Science Week 2017 digital badges. Register for free at **makewav.es/britishscienceweek** and students can upload evidence of their BSW activities to gain the badges. It's a great way to quickly evidence and reward everyone's hard work.

Demo Day
Taking place on Thursday 16 March, Demo Day is an annual campaign held during British Science Week that aims to inspire school teachers and technicians to explore new concepts, provoke discussions and generate excitement through running science demonstrations. Many activities found in this pack are suited to Demo Day, simply look for the 'Wow' symbol above. Share what you got up to on Demo Day by using the hashtag #DemoDay17 on social media. Stories, photos and videos – the more visual the better!

Find out more at britishscienceweek.org/plan-your-activities/demo-day

The British Science Week 2017 digital badges

Poster competition
Some of the activities could be followed up by designing a poster, simply look out for the paintbrush symbol above. The theme for this year's competition links with this year's activity pack theme of 'change'. For more information on the competition and how to enter, read on further in the activity pack or visit britishscienceweek.org/plan-your-activities/poster-competition

Photo competition
Try out the new Technicians Make it Happen photo competition. Share an image of a representation of a technician on Twitter to be in with a chance of winning a wonderful array of prizes!
To find out more, read on in the activity pack or visit britishscienceweek.org/technicians-make-it-happen

BRITISH SCIENCE WEEK 2017

The theme for this year's British Science Week is "Change", encouraging young people to think about and investigate the changes happening in the world all around us; from seasons and climate, to materials and energy. It is also a chance for young people to consider the changes they can enact to have a positive impact on the future.

BRITISH SCIENCE WEEK 2017

CHALLENGES

ANAGRAMS

Solve the anagrams, using the clues provided.

GENUS PIN

Clue Black and white animal and book publisher

MACHINE CAT LEG

Clue Human impact on the environment

ENCHANT GOO ONLY

Clue Tiny tech

LIVER BERRIES

Clue Cannot be changed back

I CARE NOT

Clue Process that transforms a substance

EARTH WE

Clue Rain, sunshine or snow

BRITISH SCIENCE WEEK 2017

CHALLENGES

CATEGORIES

Categorise the words into the appropriate group (4x4), and then identify the theme of each group.

Words:

Waxing	Metre	Fools	Waning
Humboldt	Kilogram	Gentoo	Second
Emperor	Full	Mole	Rockhopper
Plated	Carat	Leaf	New

Example

types of chocolate	Bitter	Dark	Milk	White

BRITISH SCIENCE WEEK 2017

CHALLENGES

ODD ONE OUT

Note: as long as you can give a clear, well-reasoned argument to support your idea, then your answer is correct.

Which of the following do you think is the odd one out?

Example

Wood

Paper

Rock

List your reasons		Because it is the only man-made thing.	It is the only thing that cannot be burnt.

Chalk

Wax

Marble

List your reasons			

Shell

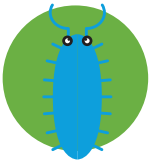
Plant

Rock

List your reasons			

Worm

Snake



Centipede

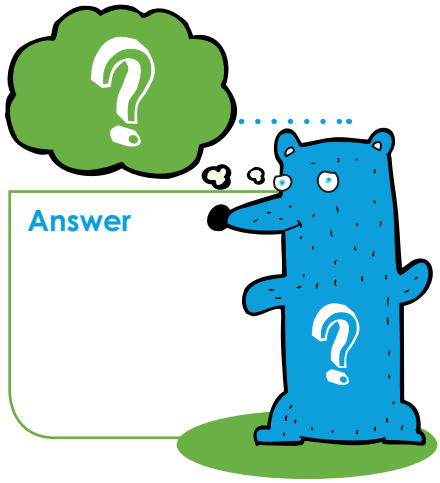
List your reasons			

BRITISH SCIENCE WEEK 2017

CHALLENGES

BRAINTEASERS

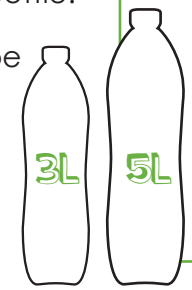
Test your lateral thinking with these fun riddles and brainteasers.



1 A bear walks south for one kilometre, then it walks west for one kilometre, then it walks north for one kilometre and ends up at the same point from which it started.
What colour was the bear?

Answer

2 You have to measure exactly 4 litres of water, but you only have a 3-litre bottle and a 5-litre bottle.
How do you do it?
(Note: there might be more than 1 way!)



Answer

3 When I'm young I'm tall.
When I'm old I'm short.
When I'm alive I glow.
Because of your breath
I die. **What am I?**

Answer

4 **What is the catchphrase below?**

arrest
you're

Answer

5 **What is the catchphrase below?**

BROTHER

Answer

BRITISH SCIENCE WEEK 2017

CHANGING COLOURS

CATCH A RAINBOW

Toolkit

- Milk
- Washing up liquid
- Shallow bowl
- Red, yellow and blue food colouring

About this activity

Some very unusual interactions take place when you mix a little milk, food colouring, and a drop of liquid soap. This artsy activity will help you discover the scientific secrets of soap and create a beautiful explosion of colours at the same time.

Watch out!

This experiment can get rather messy so ensure your workspace and clothes are well protected. Afterwards, make sure you wash the bowl thoroughly and wipe up any spills carefully.

Part 1
Get colourful

Pour a cup of milk into a shallow bowl and carefully put three drops of red colouring into one side. About a third of the way around put three drops of blue food colouring and another third of the way around put three drops of yellow food colouring. Do this very carefully, without moving the bowl, so that the three colours do not mix.

Next squeeze a drop of washing up liquid into the centre of the bowl and record what you see. What happens to the colours?

Part 2
Think about it

Think about the chemical changes occurring:

- What is the dish soap doing to the bonds?
- What molecules are present within the solutions?

Part 3
Mix it up

You could try repeating the experiment using water in place of milk.

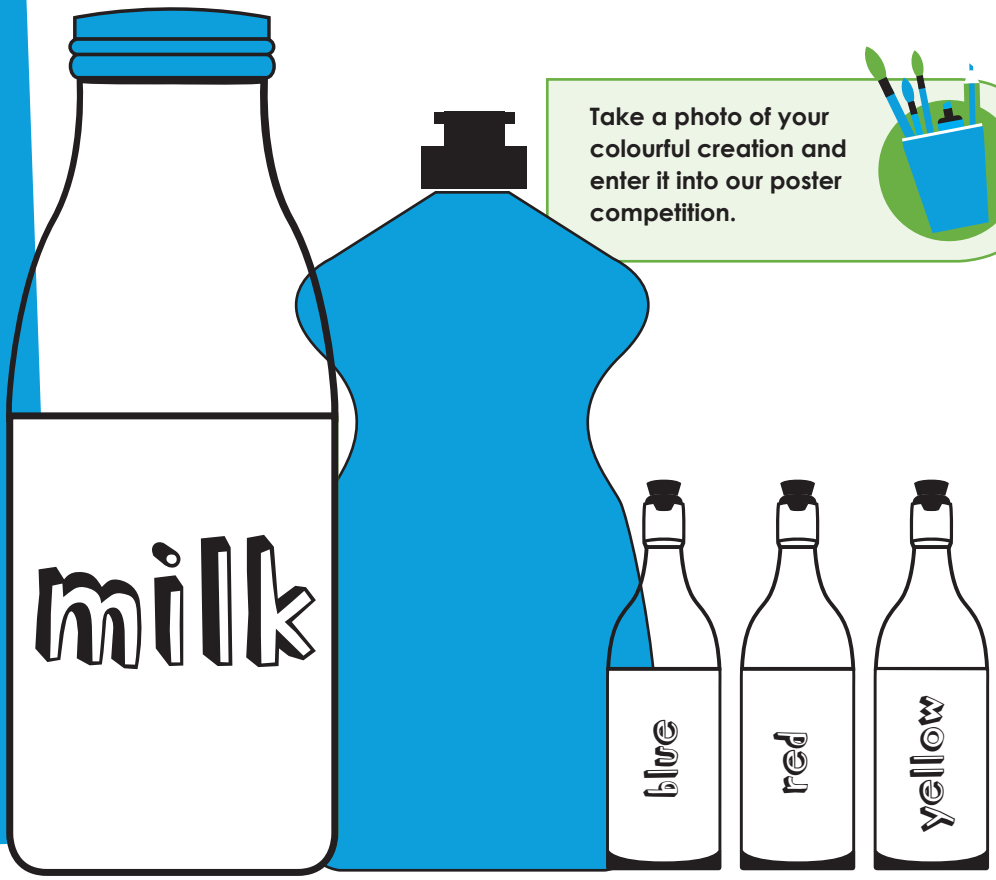
Observe whether you get the same eruption of colour or not.

You could also test out different types of milk (but never unpasteurised) and explore which % of fat produces the best swirling of colour? Semi-skimmed or full-fat – which is better?

Next steps

For more ideas of experimental science projects you can do, read about CREST
crestawards.org/project-resources

Take a photo of your colourful creation and enter it into our poster competition.



BRITISH SCIENCE WEEK 2017

CHANGING COLOURS

FLOWERS TO DYE FOR

Toolkit

- White flowers
- Water
- Food colouring
- Vase

About this activity

This colourful activity demonstrates how plants absorb water through their roots and the xylem within their stems. Add a little food colouring to the vase in order to transform white flowers into different colours.

Watch out!

This experiment can get rather messy so ensure your workspace and clothes are well protected.

Part 1

Get colourful

Fill your vase with water and add a few drops of food colouring. Cut the bottom off the stems of your flowers and place them in the vase. Leave your flowers in the coloured water for a few hours and observe what happens.

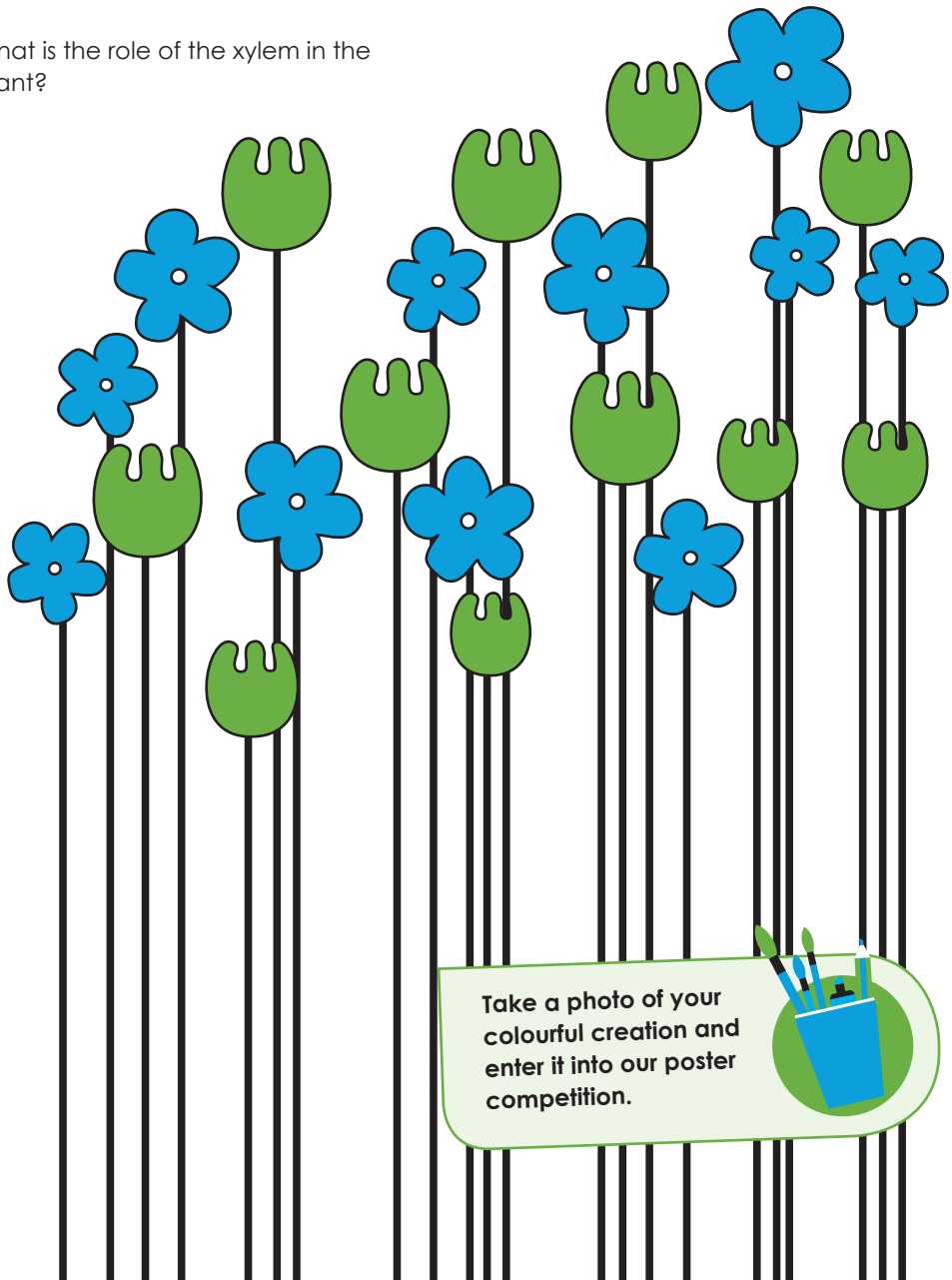
It should take between 6 – 12 hours to get the best results, so perhaps check again at the end of the day.

Try splitting the stem of your flower in half and putting each half in water dyed a different colour. What do you think will happen?

What is the role of the xylem in the plant?

Next steps

For more ideas of experimental science projects you can do, read about CREST
crestawards.org/project-resources



BRITISH SCIENCE WEEK 2017

CHANGING COLOURS

CHANGING CHANGE

WITH THE ROYAL SOCIETY OF CHEMISTRY AND THE NUFFIELD FOUNDATION

Toolkit

- 24g Sodium hydroxide pellets (corrosive)
- 5g Zinc powder (highly flammable, dangerous for the environment)
- Steel wool
- 100cm^3 deionised or distilled water
- Copper coins
- Protection: eye goggles and disposable gloves (preferably nitrile)
- Beaker (250 cm^3)
- Bunsen burner, tripod and gauze
- Pair of tongs or forceps
- Glass stirring rod
- Access to a top-pan balance

About this activity

Change your change in this exciting demonstration exploring electroplating and the chemistry of alloys, where a copper coin is firstly changed to silver, and then to gold.

This is a demonstration for teachers to carry out, and for students to watch in awe.

Watch out!

This experiment requires you to wear goggles and disposable gloves. Any remaining finely powdered zinc should not be left to dry because it can ignite spontaneously. Dispose of it by rinsing with water, dissolving in excess dilute sulfuric acid and washing the resulting zinc sulfate solution down the sink. Since hydrogen is evolved from a hot solution of zinc in sodium hydroxide, an alternative source of heating is to be preferred, e.g. an electric heating plate. If a bunsen burner is to be used then it should be turned off before the zinc is added. If steel wool isn't available a proprietary mild abrasive material (for example, 'Brillo' soap pads) can be used instead. Likewise, copper foil can be used instead of real coins.

Refer to CLEAPSS Hazcards for information on how to handle hydrogen gas, sodium hydroxide and zinc power.

Part 1

Before the demo

Dissolve 24g of sodium hydroxide in 100 cm^3 of deionised/distilled water in a 250 cm^3 beaker, stirring continuously. The solution will get warm and is corrosive. Heat the solution to boiling point on a Bunsen burner, and after this, turn the Bunsen off.

Add 5g of zinc powder carefully. The solution will fizz as some of the zinc dissolves, forming sodium zincate and giving off hydrogen.

Clean a 'copper' coin with steel wool until it is shiny.

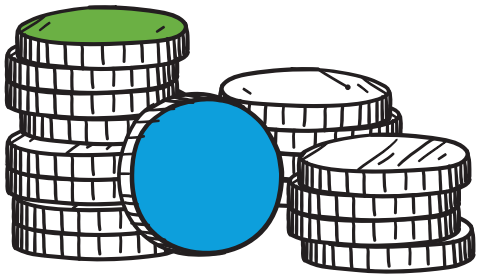
Part 2

Turn copper to silver

Drop the cleaned coin into the hot solution containing sodium zincate and the remaining zinc powder. The coin must make contact with the powdered zinc at the bottom of the solution. If necessary, use a glass rod to move the coin about until this is so.

Leave the coin until it is plated with a shiny coat of zinc. This will take about 2-3 minutes. Leaving the coin too long may cause lumps of zinc to stick to it. Remove the plated coin with tongs or forceps and rinse it under running tap water to remove traces of sodium hydroxide and sodium zincate. You will now have a 'silver' coin!

Why not try this for **Demo Day?**



Part 3

Turn silver to gold

Using tongs or forceps, hold the plated coin in the upper part of a roaring Bunsen flame for a few seconds until the surface turns gold. Turn the coin so that both sides are heated equally. Overheating will cause the coin to tarnish.

Allow the coin to cool and you will now have a 'gold' coin!

Next steps

This resource has been adapted from the **"Turning copper coins into 'silver' and 'gold'"** resource from the Practical Chemistry collection, ©The Nuffield Foundation and the Royal Society of Chemistry.

For more resources visit **rsc.org/learn-chemistry**

Nuffield Foundation

ROYAL SOCIETY OF CHEMISTRY

BRITISH SCIENCE WEEK 2017

CHANGING STATES

OOBLECK SLIME

Toolkit

- Large mixing bowl
- Measuring jug
- Cornflour
- Water
- Spoon
- Clear re-sealable storage bag
- Eggs (optional)

About this activity

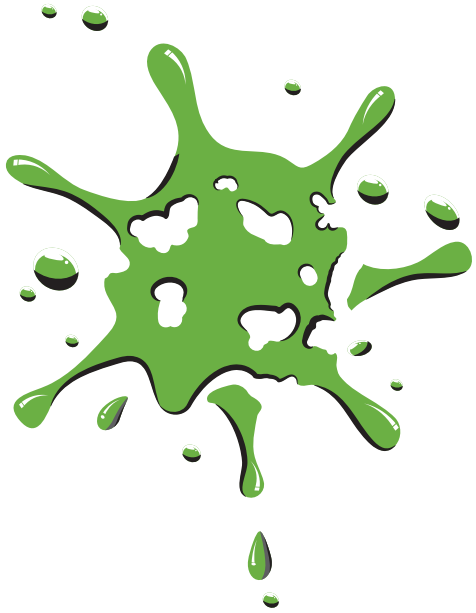
Fancy making a weird slimy concoction that acts like a liquid but behaves like a solid when you hit it? Most liquids behave in a predictable manner, but oobleck slime does not stick to the rules and acts in a very curious way. This is because it is a non-Newtonian fluid.

Watch out!

When you've finished, do not pour the slime down the sink as this could clog the pipes, instead spoon the mixture into a zip-lock bag, fasten it tightly and dispose of it in a bin. Ensure you only use eggs with the 'British Lion Quality' stamp as these should be salmonella free.

Part 1
Make some slime

Place some cornflour into a large mixing bowl and little by little, add water and use your hands to mix it into the cornflour. Keep mixing until the cornflour and water have blended together and the slime is the consistency of thick honey. Make sure you add the water slowly and carefully.



Part 2
Put the slime to the test

Once you've made your slime, try out a few experiments to see how your slime reacts. Do you think your slime is a liquid or a solid?

Why not try the following? Test out:

- Punching the slime and drawing back your hand quickly
- Scooping some of the slime into your hand and rolling it into a ball between your palms
- Leaving your slime out over a few days/overnight and seeing if you can you make it slimy again once it has dried out
- Spooning some of the slime into a re-sealable storage bag until it is two-thirds full, and then gently pushing an egg or another delicate object (e.g. a biscuit) into the mixture. Then try dropping the bag from a tall height (around 2-3m) and see how high you can you drop it from before the object breaks
- Making your slime 'dance' by placing some on a plastic plate over the top of speaker set to a low frequency sound

Next steps

'For more ideas of experimental science projects you can do, head to crestawards.org

Why not try this for **Demo Day?**

BRITISH SCIENCE WEEK 2017

CHANGING STATES

ERUPTING FIZZ

WITH THE INSTITUTE OF PHYSICS

Toolkit

- Large glass
- Fizzy drink – preferably a clear one
- Vegetable oil
- Food colouring
- An Alka-Seltzer tablet
- Some salt
- Stirrer

About this activity

Turn simple household ingredients into a foaming eruption, like that of a volcano!

Watch out!

Ensure you protect your workspace and clothes during this experiment.

Part 1
Get fizzy

Half-fill the glass with the fizzy drink and then pour vegetable oil into the glass so that it is roughly two-thirds full. Add a few drops of food colouring and stir the mixture. Wait until the two layers have clearly separated.

Add approximately two tablespoons of salt to the liquid in one go. A great foam eruption will occur. Observe the liquids after the eruption has settled down. You should be able to see a lava-lamp-style bubble effect.

Add an Alka-Seltzer tablet to the liquid. You should see some interesting bubbling effects from the gas given off by the Alka-Seltzer, and the change in the speed of those bubbles as they travel through water versus oil.

Part 2
Keep it fizzing

This trick can keep working for quite a while if you add more Alka-Seltzer. You won't see the big fizzy eruption once the drink loses its fizz, but the bubble effect is still very clear.

Make sure that your fizzy drink isn't too dark to allow you to see the bubbles passing through the liquid.

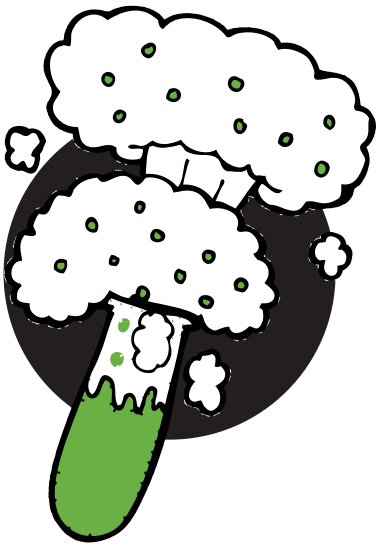
Part 3
Think about it

Consider the following affects you have observed:

- Why don't water and oil mix well?
- Why does adding salt to a fizzy drink cause a foamy eruption? What gases are being creating?
- Why, when the Alka-Seltzer is placed into water, does it start fizzing?
- Why do the bubbles travel at different rates through the different layers?

Next steps

Find more activities and resources on the Institute of Physics website **physics.org/discover**



WOW!

Why not try this for **Demo Day?**

IOP Institute of Physics

BRITISH SCIENCE WEEK 2017

CHANGING STATES

KITCHEN CHEMISTRY

WITH FOOD TEACHERS CENTRE

Toolkit

You'll need to measure and mix this set of ingredients four times to complete all four tests:

- 6 tablespoons flour
- 3 tablespoons sugar
- 2 or 3 pinches of baking powder
- 2 tablespoons cooking oil
- 1/4 teaspoon vanilla
- 1/3 of an egg (break egg into a cup; beat until mixed, then use approximately one third of it. Save the rest for the other cakes)
- Baking tray and cupcake cases
- Oven
- Cooling rack

About this activity

Get your bake-on and make some quirky cakes. Baking is often thought of as an exact science: with precise measurements, temperatures and timings resulting in a tasty transformation. But what do all the ingredients do? What happens if we change the recipe and a key ingredient is missed out?

Watch out!

Ensure health and safety precautions are taken when working with raw ingredients and a heated oven. Ensure you only use eggs with the 'British Lion Quality' stamp as these should be salmonella free. Check for any food allergies prior to undertaking this activity. Do not do food-related experiments in school labs if you intend to eat the results. Ensure that appropriate hygiene and cleanliness precautions are in place.

Part 1
Get baking

Mix the dry ingredients altogether in a mixing bowl and then add the wet ingredients in the order listed in the 'toolkit' section. Mix well and divide equally into 12 cupcake cases.

Bake at 180 degrees Celsius for 15-20 minutes. Take the cakes out when golden brown and allow them to cool on a rack!

Part 2
Alter the recipe

Now experiment what happens when you change the recipe. Try to:

- Mix one without the egg
- Mix another without the oil
- Mix one without baking powder

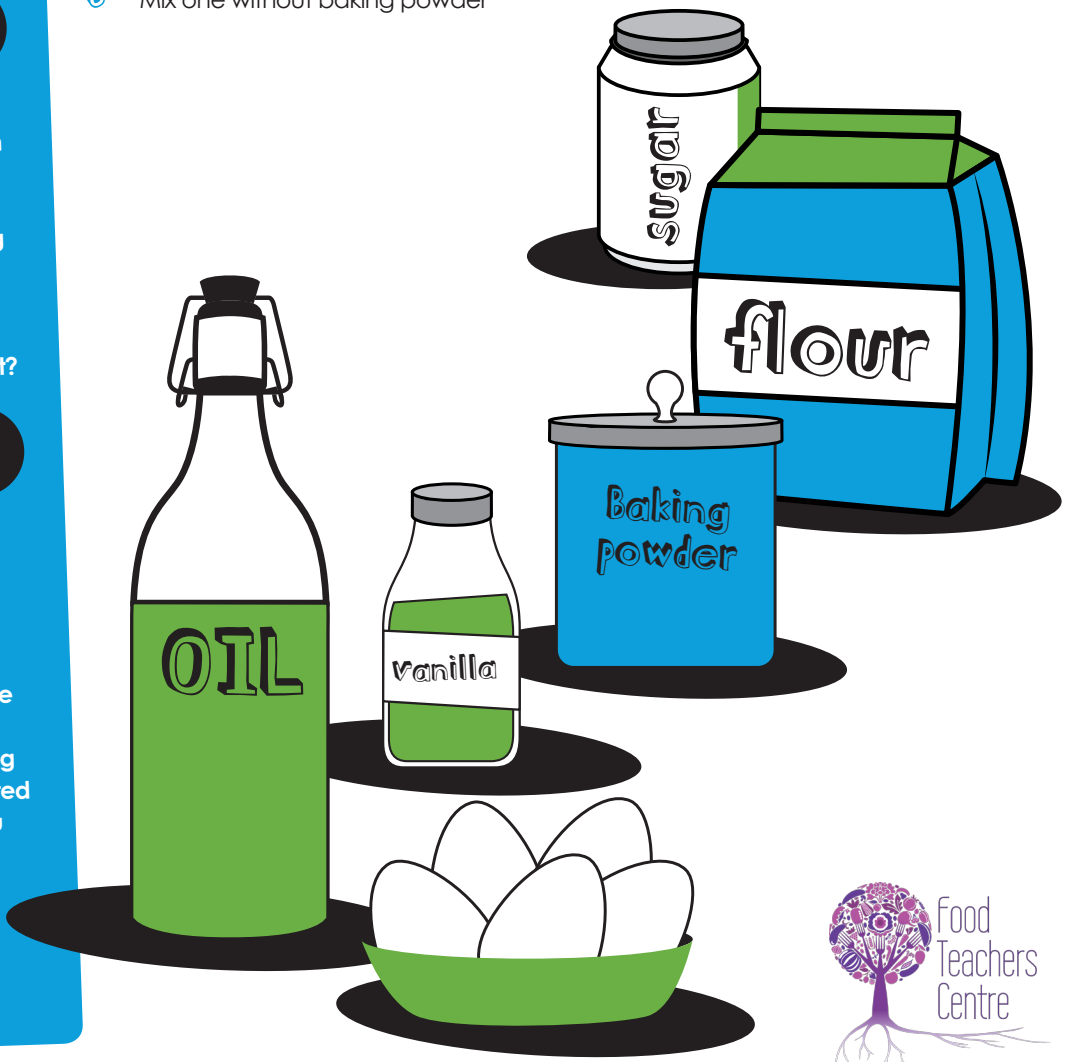
Part 3
Test your creations

Observe the differences in size, texture and appearance, and also have a taste to see which cake is the best:

- How and why is each cake different?
- What might be the purpose of each ingredient in the cake?

Next steps

If you liked trying out some kitchen chemistry, check out the Food Teachers Centre for a wide variety of resources **foodteacherscentre.co.uk/resources**



Food Teachers Centre

BRITISH SCIENCE WEEK 2017

CHANGING STATES

CHOCOLATE EGGS

WITH THE ROYAL SOCIETY OF CHEMISTRY AND THE NUFFIELD FOUNDATION

Toolkit

- A few grams of chocolate (cooking chocolate works best)
- Egg albumen/white (about 4 cm^3)
- Protection: eye goggles
- 2 test tubes
- Beaker (250 cm^3)
- Bunsen burner, heat resistant mat, tripod and gauze
- Test tube rack
- Test tube holder

About this activity

What makes a change reversible or irreversible? Explore the physical and chemical changes of both chocolate and eggs (not chocolate eggs!) in this simple yet interesting experiment.

Watch out!

Wear eye protection. Do not taste foods in a laboratory. Do not sit down while heating the beaker or handling the hot test tubes. Ensure you only use eggs with the 'British Lion Quality' stamp as these should be salmonella free.

At the end of the experiment, the chocolate is best removed by re-melting and pouring out of the tubes.

WOW!

Why not try this for **Demo Day?**

Part 1
Get set up

Set up a Bunsen burner on a heat resistant mat, with a tripod and gauze above it.

Grate the chocolate and pre-load test tubes to give about a 2cm depth of molten chocolate when melted.

Separate the egg whites from the yolks of sufficient eggs to provide enough for about 4cm^3 of egg white for each test tube.

Part 2
Be observant

Add cold water to the beaker until it is about one-third full, and place it on the tripod and gauze. Place the test tube containing the egg white and the test tube with the chocolate in the beaker.

Using the Bunsen burner, heat the beaker of water with the test tubes carefully until the water in the beaker boils. Allow the water to boil gently for about 5 minutes.

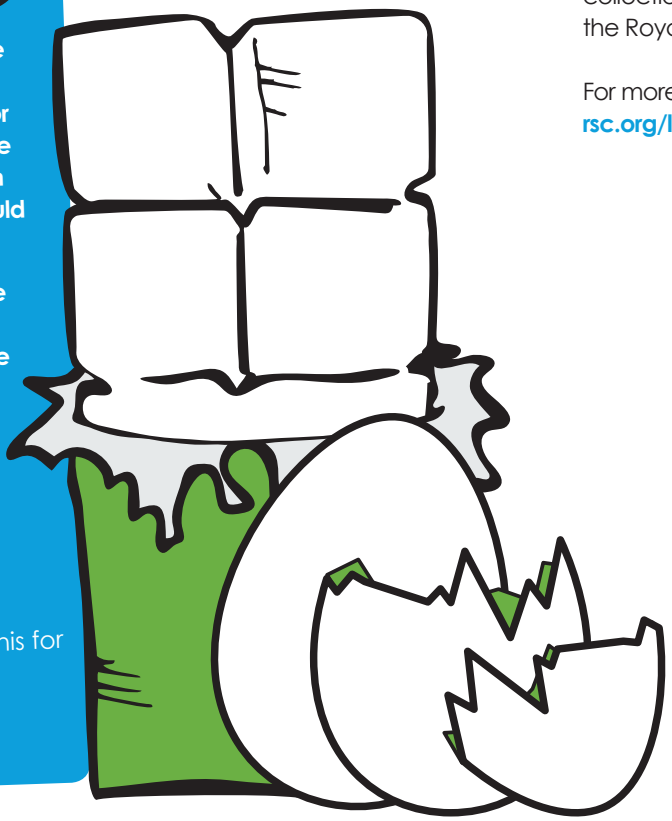
Keep an eye on what happens to the egg white and the chocolate in the tubes whilst they are being heated. What observations can you make?

Turn off the Bunsen burner and use the test tube holder to transfer the tubes to the rack to cool. Watch what happens to the egg white and the chocolate in the tubes as they cool.

Next steps

This resource has been adapted from the "**Chocolate and egg experiment**" resource from the Practical Chemistry collection, ©The Nuffield Foundation and the Royal Society of Chemistry.

For more resources visit **rsc.org/learn-chemistry**



ROYAL SOCIETY OF CHEMISTRY

Nuffield Foundation

BRITISH SCIENCE WEEK 2017

CHANGING ENVIRONMENT

CHANGING LIKE THE WIND

WITH THE ROYAL METEOROLOGICAL SOCIETY

Toolkit

- Bubble blowing kit
- Compass or compass app
- Measuring tape
- Watch or stopwatch

About this activity

Whether it's a gentle breeze or blowing a gale, explore how the wind changes, using bubbles to measure both direction and speed.

Watch out!

Ensure that you are aware of your safety when working outdoors and are supervised at all times. Choose an area of open ground, a safe distance from roads or private property.

Part 1

Track the wind direction

Place a marker at your start location, and then blow some bubbles and pick one to follow. Chase your chosen bubble, without getting in its way, until it pops or floats somewhere you cannot follow.

Blow another bubble from where you end up and follow that one. Repeat this up to ten times if possible. Wherever you end up, look back at where you have come from.

Now use your compass to work out the direction back to the starting point. This will give you the average wind direction, because wind direction refers to where the wind is blowing from.

Part 2

Work out the wind speed

Assign someone to be a 'blower' and another as a 'timer'.

Place a marker at your start location and another marker 10 metres away (roughly ten paces), in the general direction the wind will carry the bubbles. This will be your bubble 'racecourse'.

Have the 'blower' blow some bubbles, and the 'timer' pick one to follow. The 'timer' uses the watch/stopwatch to measure how long it takes the bubble to reach the finishing line. From this time it takes to travel 10 meters, you can calculate the wind speed.

Use the following equation:

Speed = distance/time

Is the wind speed and direction the same everywhere, or can you find differences, for example as you move around a building?

Next steps

For more activities from the Royal Meteorological Society, take a look on their website **metlink.org**

RMetS
Royal Meteorological Society

BRITISH SCIENCE WEEK 2017

CHANGING ENVIRONMENT

MY 'MOON DIARY'

WITH BBC TERRIFIC SCIENTIFIC

Toolkit

- Pen/pencil
- Notebook

About this activity

Our Moon is beautiful and we've been staring at it for years! It is said we know more about the surface of the Moon than we do about the depths of our oceans. But what if we can't see it? Can we see the same amount of the Moon every night?

This activity will show you how differently we see the Moon over time by keeping a diary, and help you come up with ideas as to why this is.

Watch out!

If you can't see the Moon from your house, you might need to go outside. Make sure you have a parent or guardian to go with you at all times if you do!

Part 1

Start your 'Moon Diary'

To start your 'Moon Diary', write the date in your notebook and leave a space next to it for your drawing of the Moon.

Part 2

Look for the Moon

You might not be able to see the Moon every evening, depending on the day you start your diary. Why could this be? If it is very cloudy and you can see light from the Moon but not the shape it appears to be, don't worry! Write this down and try again tomorrow.

Part 3

Draw the Moon

Draw the Moon each night for a month. Consider whether the Moon looked the same yesterday as it did today? What about two weeks ago? Why do you think this could be?

If you cannot see the Moon, sketch the shape of the light coming from it, by drawing a circle and colouring it in, so the bits left blank are what you can see in the sky.

Part 4

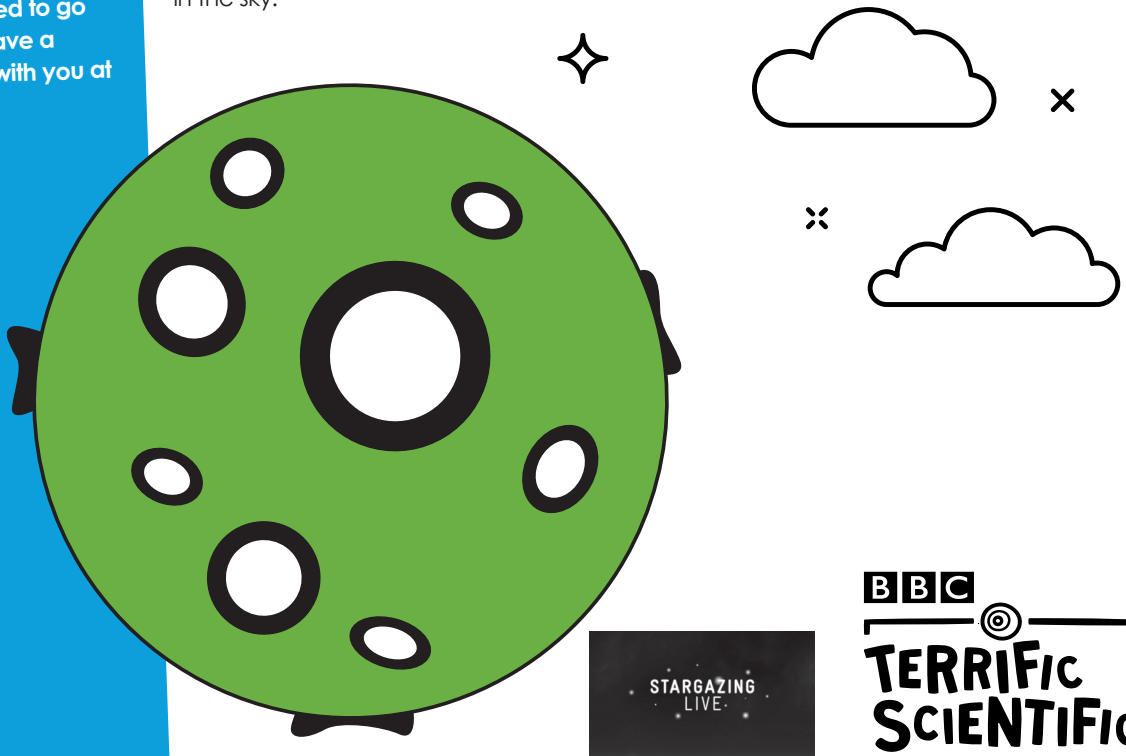
Learn how the Moon moves

Make sure you check out the BBC Terrific Scientific website to learn more about the Earth and how the Moon moves around it **bbc.co.uk/terrificscientific**

Next steps

If you liked this activity, be sure to check out the BBC Terrific Scientific website **bbc.co.uk/terrificscientific/sections/terrific-stuff** where you'll find many more fun things to do!

This activity links to the Terrific Scientific Time Investigation, which your school can take part in. Make sure your teacher has signed up for this exciting mass investigation and find out more at **bbc.co.uk/terrificscientific/sections/teachers** or **bbc.co.uk/terrificscientific/sections/cymraeg**



STARGAZING LIVE

BBC TERRIFIC SCIENTIFIC

BRITISH SCIENCE WEEK 2017

CHANGING OUR WORLD

FLOATING GARDENS:

A SOLUTION TO CLIMATE CHANGE?

WITH PRACTICAL ACTION

Toolkit

- Practical Action floating garden PowerPoint presentation: practicalaction.org/floatinggardenchallenge
- Modelling equipment such as 250ml plastic drinks bottles, small plastic and polystyrene food trays, straws, plasticine, string, card, doweling, packaging with air pockets, cartons, sellotape, masking tape, elastic bands, corks, yoghurt cartons, lolly pop sticks/wooden spills, blu-tac, bubble wrap
- Scissors
- Washing up bowls or sinks half-filled with water
- Weights up to 5kg

About this activity

Climate change is having a major impact on communities across the world, especially those living in areas close to our oceans and rivers. A heavier and longer rainy season means that land where farmers used to be able to grow crops to feed their family is being flooded before crops can be harvested.

In this hands-on investigatory challenge, design and make a structure that enables farmers in Bangladesh to continue to grow their crops even when their land floods.

Part 1
Solving the problem

Look over the materials you have available to you before starting to develop a design idea for your floating raft.

Tips for your floating garden:

- For crops to grow on flooded land they need to be planted on a raft like structure, or 'floating garden' so make sure your model floats
- The top of your model should be fairly flat so you could grow your own garden on top of it
- Your model must not be wider or longer than 23 x 30 cm, but can be as deep as you like
- Ensure you make a model that will be able to carry as much weight as possible before sinking

Remember to test and adapt your models along the way

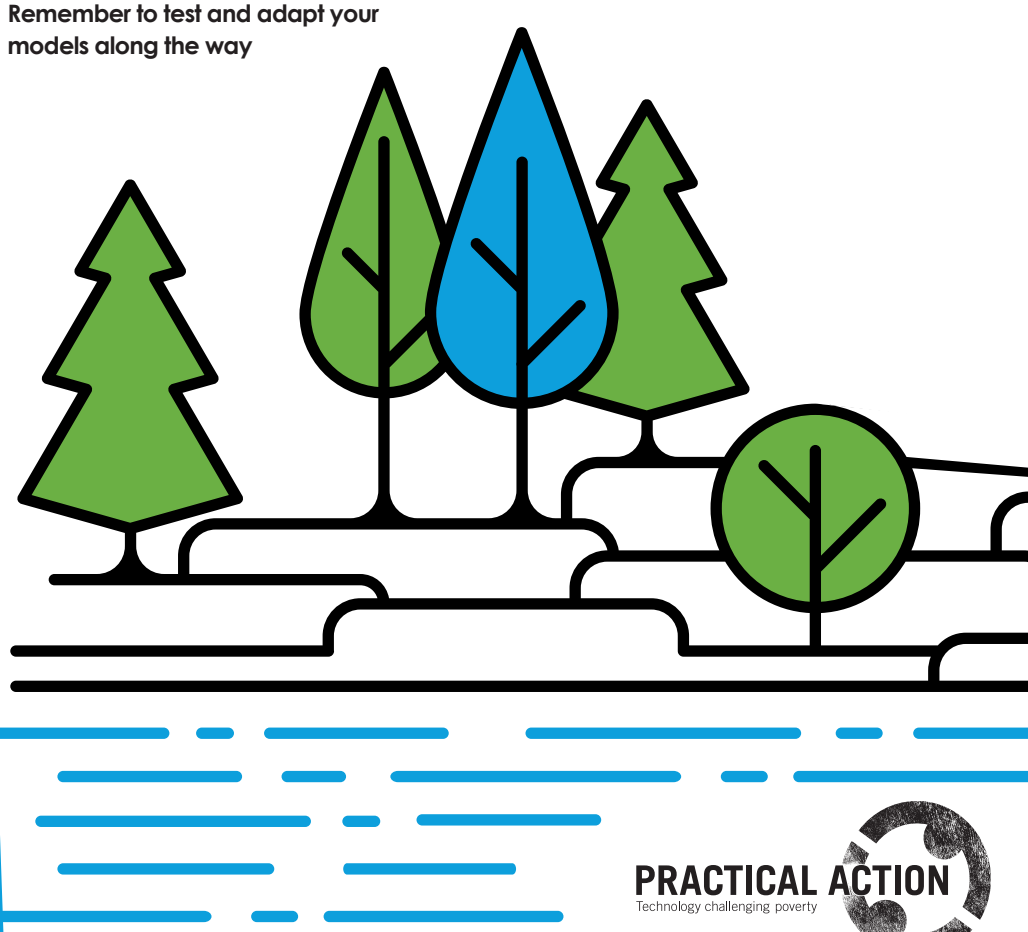
Part 2
Test it out

Each group will have their floating garden tested in a sink or washing up bowl with about 10cm of water in the bottom. Weights will be added gradually to the raft and the winning team will be the one whose model supports the most weight.

Next steps

For more support materials, including the PowerPoint presentation, go to **practicalaction.org/floatinggardenchallenge**

For more Practical Action resources, go to **practicalaction.org/stem**



PRACTICAL ACTION
Technology challenging poverty

BRITISH SCIENCE WEEK 2017

CHANGING OUR WORLD

ENRICH YOUR CLASSROOM

WITH URENCO

Toolkit

- URENCO nanotechnology fact files: crestawards.org/enrich-my-classroom
- Pen/pencil
- Paper
- Magic Sand
- Washing up bowl/tray filled with water
- Sweets (skittles, m&ms), counters, beans, etc.
- Large gloves (oven or garden)

About this activity

Nanotechnology refers to items which are very small in size and often requires the careful manipulation of both atoms and molecules. In this activity, you will investigate what nanotechnology is, find some specific examples and see how nanotechnology can be used to enrich and improve your school.

Part 1

What is nanotechnology?

Do some research into what nanotechnology is and how it works. Look at examples in a variety of settings such as:

- Healthcare
- IT/computing
- Building/infrastructure
- Communications
- Medicine

Magic Sand, also known as hydrophobic sand, is ordinary sand that has been coated with a special compound that repels water. This means that when the sand is submerged in water and removed it stays completely dry. Explore this nanotechnology application by testing out some Magic Sand in a bowl/tray of water.

To get an idea of the difficulties of controlling items on a small scale, work with a partner to lay out the letters of a word (e.g. URENCO) using sweets, counters or beans whilst wearing large gloves. Be competitive against your friends and see who can complete the word fastest!

Part 2

Can you change your school using nanotechnology?

Using what you have learnt about nanotechnology, what products are available that might be able to help with the following challenges at school?

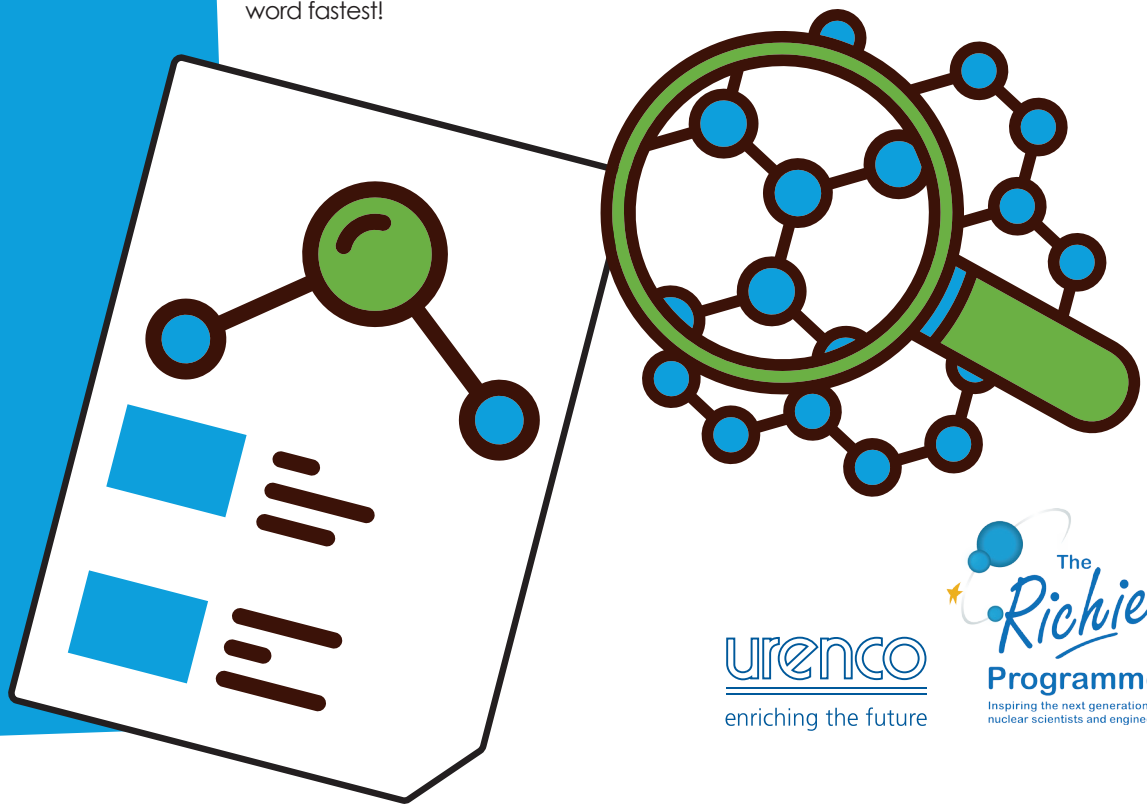
- Graffiti
- Stains on clothes
- Waterproofing of technology, e.g. phones
- Heat loss
- Electricity generation

How would the use of these technologies change and impact your school environment?

Next steps

For other ways to enrich your classroom including workshops on electricity, coding, ergonomics and magnetism, and for resources supporting a CREST Discovery Day, go to **crestawards.org/enrich-my-classroom**

For more URENCO resources, visit **learnwithrichie.com**



urenco enriching the future

The Richie Programme
Inspiring the next generation of nuclear scientists and engineers

BRITISH SCIENCE WEEK 2017

CHANGING OUR WORLD

BEST DAY EVER

WITH THORPE PARK RESORT

Toolkit

- Map of theme park thorpepark.com/img/park-mapside-2016-final-no-folds.pdf
- Markers/pens
- Paper
- Calculator
- Internet access
- Printer

About this activity

This activity tasks you to act as a theme park manager, responsible for ensuring that guests are happy. To improve visitor experience, design a family-friendly route through the THORPE PARK Resort, which includes a wide variety of rides making it the best day possible for the entire family.

Part 1
Getting ready

Download a map from the THORPE PARK Resort website and review the route planner facts below. Your challenge is to create a course through the park for a family of two adults and two teens. Everyone is over 1.4 metres tall, so can go on all rides, but mum and daughter love the excitement of roller coasters, while dad and little brother prefer water spills and mini thrills.

Design your route taking into account walking and waiting time between rides. There are no fastrack tickets available and you must include a 30-minute lunch-break and two 15-minutes snack/toilet stops!

Try to fit in as many different rides as possible but don't over-estimate and end up disappointing the guests!

Route Planner Details

- Family enter at 9:30am and exit at 5:00pm.
- Consider where and how the family could divide and meet up again so that everyone can have their favourite experience.
- It takes 20 minutes to walk across the park. The map is not to scale but can be used to estimate distances/times between rides. You could include estimates of ride times.
- The most popular attraction, 'Derren Brown's Ghost Train', has a wait of 45 minutes. Stealth, SAW – The Ride, Colossus and Nemesis Inferno all have queues of 30 minutes from 10:00-11:30am and from 1:00-3:00pm.
- Rides closest to the entrance, especially 'The SWARM', have longer waits in the mornings, while farther away rides are longer in the afternoons.
- Newer rides attract more guests.
- Samurai, Rush, Vortex and Tidal Wave usually have a short line of 10 minutes, or 20 minutes between 11:30–3:00pm.
- Most families have lunch between 12 -1:00pm. Restaurants are very busy then.
- Water-based rides are busier after lunch.
- Other rides have a typical wait of 5 minutes, or 15 minutes from 2:00-4:00pm.

Part 2
Plan your route

Create a family fun-day leaflet that contains an outline route on the map. Include a timetable for the day, with short notes on ride arrival times, estimated queuing times and walking time between rides.

Most Theme Park Managers aim to make waiting entertaining. They often study the psychology of queuing to help. For example, people in line for 'The SWARM' experience sound and visual effects based on an alien invasion. What could you include on the leaflet that would keep the family engaged while waiting?

Next steps

Start a debate: Which route is the best? #BSWThorpe

Look out for THORPE PARK Resort's Discovery Day Resources coming soon!

THORPE PARK

BRITISH SCIENCE WEEK 2017

CHANGING OUR WORLD

PROTECT YOURSELF

WITH YOUTH GRAND CHALLENGES

Toolkit

- Internet access
- Pens
- Paper
- Anti-malarial medicines and insect repellents (optional)

About this activity

Vaccinations protect people from lots of infectious diseases but, despite years of research, there still isn't a completely-effective vaccine for malaria. But there is hope! In this activity, you will investigate anti-malaria tablets and insect repellents, then use your communication skills to tell travellers about the range of ways they can protect themselves from malaria.

You can use this activity for a Bronze CREST award and to enter the Youth Grand Challenges competition.

Watch out!

Ensure that you are aware of your safety when looking at medicines and insect repellents.

Part 1
Investigate

Imagine you are a healthcare professional that has been approached by a group of voluntary workers. They are planning a trip to Mozambique, an African country where malaria is present. They want your advice on how best to prepare for the trip and how to protect themselves from malaria. Do some research into malaria and the different prevention methods used by healthcare professionals around the world.

Have you considered:

- How people protect themselves from illnesses when they travel abroad?
- Why there are often many types and brands of medicines for the same illness?
- How useful insect repellents are, and which type is most effective?

Part 2
Communicate

There's a lot of information to communicate. What's the best way to do this? For example, information leaflet, email, social media, a presentation, or some other approach? How can you ensure that the information and advice you give is accurate, clear and concise?

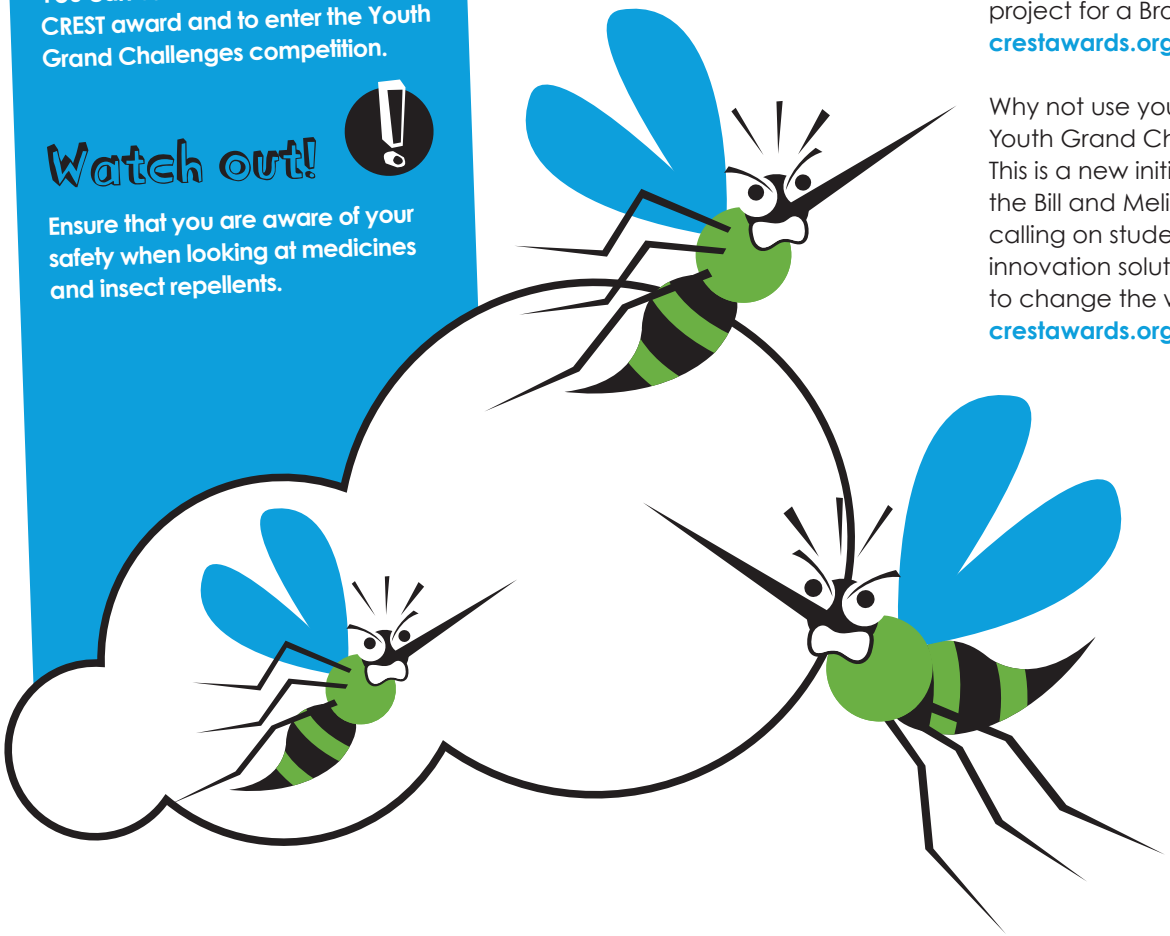
Use your communication skills to tell the volunteers about:

- The choice of anti-malarial drugs, summarising the advantages and disadvantages of each
- The choice of mosquito repellents, summarising the advantages and disadvantages of each
- Other steps that can be taken, such as clothing to wear and mosquito netting.

Next steps

For the full resource or to submit your project for a Bronze CREST award go to **crestawards.org**

Why not use your project to enter the Youth Grand Challenges competition? This is a new initiative supported by the Bill and Melinda Gates foundation, calling on students to develop innovation solutions with the potential to change the world. Find out more at **crestawards.org/protect-yourself**



CREST AWARDS

YGC YOUTH GRAND CHALLENGES

BRITISH SCIENCE WEEK 2017

CHALLENGES

PENGUIN WATCH: CITIZEN SCIENCE

WITH ZOONIVERSE AND PENGUIN LIFELINES

Toolkit

- A computer/laptop or mobile/tablet
- Internet access
- A keen eye

About this activity

Climate change is having many negative effects around the world, and one area feeling it more than others is the cold icy region of Antarctica. Many wonderful wildlife species are in decline from changes to their food supply and habitat, and there is a huge gap in our understanding of the Antarctic ecosystem. As a result, Penguin Lifelines has teamed up with citizen science organisation Zooniverse to help measure changes to penguin populations.

Penguin Watch is a citizen science website that is trying to understand the lives of penguins. To do this, scientists have travelled to some of the coldest areas on the planet to learn more about penguin populations. However, they need your help to examine hundreds of thousands of images of wildlife in Antarctica and the Southern Ocean that have been taken over the past three years. Get involved and be a part of the conservation effort!

Part 1
Get online

Head to **www.penguinwatch.org** register an account and log-in.

If you want your school to sign up and you want to adopt a specific colony, register as normal and then contact the organisation.

Part 2
Pick out a penguin

This online activity involves you individually marking adult penguins, chicks, and eggs in the image presented to you on the screen.

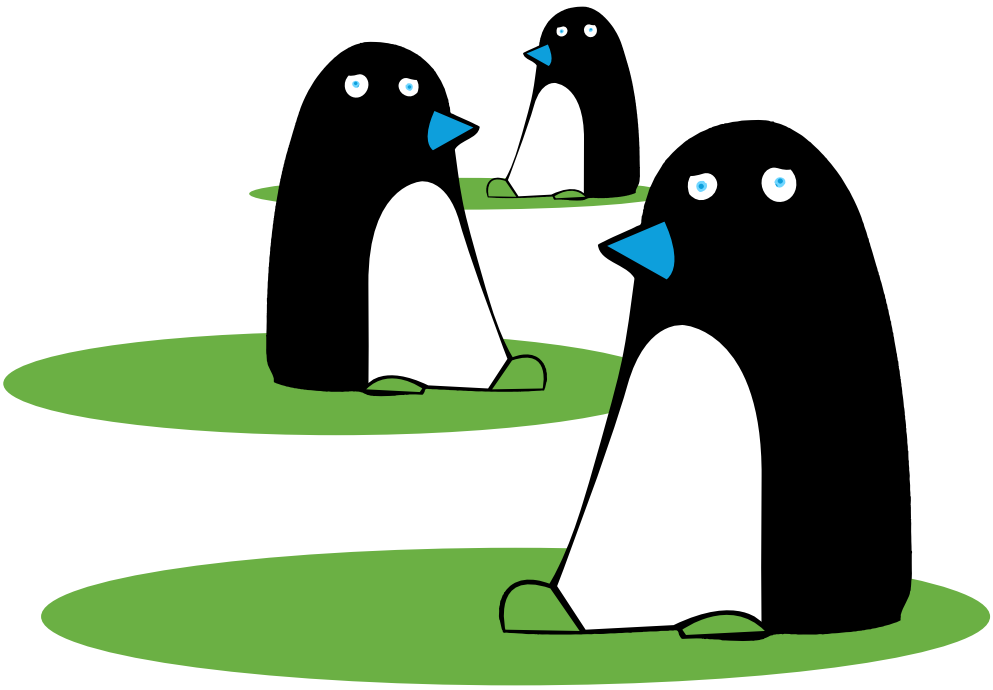
How does it work?

- Choose whether an individual is an 'adult', 'chick', 'egg' or 'other', then click and drag the marker to its centre
- Remove any accidental marks using the black-and-white cross
- If the penguins are too small to count or too far in the background, don't worry, simply mark any in the foreground and then click "Too many penguins to mark"
- Bad weather? Just click "I can't tell"
- Partially obscured? Click as many penguins as you can
- Mark any other animals you see in the image too, so the scientists can see how often they are found near the penguins' nests

Next steps

If you want to discuss a specific image, or even the whole project, visit Talk *Penguin Watch* to chat with the science team and other volunteers.

To get involved with other citizen science projects, head to **zooniverse.org**



ZOONIVERSE

BRITISH SCIENCE WEEK 2017

CHALLENGES

POSTER COMPETITION

Toolkit

- Paper (A4 or A3)
- Creative materials such as pens, pencils, scissors, glue, watercolours, paint, colouring crayons, glitter, pipe cleaners, felt, thread, wool, foil, clay, straws, string, beads, stamps, googly eyes, foam, sequins, pop pops

About this activity

Get creative and enter the British Science Association's annual poster competition. You can make your poster about whatever type of change you like, and enter into our UK-wide competition with the chance to win an array of prizes, including a copy of the new Roald Dahl's 'George's Marvellous Experiments' book!

Many activities found in this pack could also be entered into the poster competition, simply look for the paintbrush above. Or you can use them to serve as a source of inspiration to get you started.

Part 1
Research your poster

Investigate or imagine the different types of changes occurring in science and the natural world around you. Choose a topic for your poster and do some research around the idea:

- What different types of change can we examine in nature?
- Carry out a science experiment and investigate the changes.
- How has our world changed over the years?
- Think about how you might change the world in the future.

Part 2
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 use materials such as paint, drawing pencils, crayons and paper.

Part 3
Send us your poster

Posters will be judged on how creative and well-researched the ideas are **and** how well the poster has been made or drawn.

Once your poster is complete, write all your information on the back, have your teacher, leader or parent/guardian fill in the online registration form, and then post your entry to us.

Next steps

Celebrate! Whether you win a prize or not, you can join **makewav.es/britishscienceweek** for free, and upload a picture of your poster to get a special BSW2017 digital badge.

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**

BRITISH SCIENCE WEEK 2017

CHALLENGES

CELEBRATING TECHNICIANS

PHOTO COMPETITION
WITH THE TECHNICIANS MAKE IT HAPPEN CAMPAIGN

Toolkit

- Camera or camera phone
- Props for dressing up and creating a scene

About this activity

We need your help to bring technicians into the spotlight! We're inviting young people, aged 5 -19 years, to use their imaginations and creativity in this hands-on photo competition.

Share an image of a representation of a technician on Twitter to be in with a chance of winning a £500 voucher and an invitation to attend the British Science Association's 'Great British Science Club' celebration event in July 2017.

Watch out!

You will need to submit your entry via Twitter or email.

Part 1
Choose your 'technician'

Look around you and find something that technicians will have helped to make. There are different types of technicians and not all of them wear traditional white lab coats. They model car engines, they design the lighting for concerts, they build film production sets, and of course many do research. But what is it really like to be a technician and what do they do day-to-day?

Why not do an internet search starting with the Technicians Make it Happen website **technicians.org.uk**, or ask your teachers about the different kinds of work that technicians do? What is it about their job that excites you? You could act out the scene by dressing up a teddy bear, teacher or a parent as your technician of choice, or create your technician using modelling materials.

Part 2
Plan your photo

The scene around your 'technician' needs to convey the type of job they do. You can use every day materials that you would find in your kitchen, equipment in your classroom, and any backdrops that you make yourself.

Remember, the photo should capture your 'technician' in their work setting, clearly conveying their job. Be creative - the scene can be as elaborate as you want, including different aspects of the technician's career.

Part 3
Snap and share!

Next snap it – use a camera or a phone to take a picture of your scene with 'Technicians Make it Happen' somewhere in the pic – it can be a sticker, post-it note, chalkboard – whatever you fancy. Finally, to enter, post it on Twitter using **#TMiHPhotoComp**. Don't forget you can follow us **@BritSciAssoc** for ideas! Alternatively, email it to us at **BSW@britishscienceassociation.org**

Next steps

For more details, including competition rules, visit **britishscienceweek.org/technicians-make-it-happen**

Technicians make it happen

GATSBY

The encouragement and promotion of vital STEM technician roles in the UK is supported by The Gatsby Charitable Foundation. Find out more at: gatsby.org.uk

BRITISH SCIENCE WEEK 2017

CHALLENGES

ANSWER SHEET

ANAGRAMS

GENUS PIN = **Penguins**

MACHINE CAT LEG = **Climate change**

ENCHANT GOO ONLY = **Nanotechnology**

LIVER BERRIES = **Irreversible**

I CARE NOT = **Reaction**

EARTH WE = **Weather**

CATEGORIES

Species of penguin	Rockhopper	Humboldt	Emperor	Gentoo
Unit of measurement	Second	Mole	Kilogram	Metre
Type of gold	Leaf	Fools	Plated	Carat
Types of moon	Full	New	Waning	Waxing

ODD ONE OUT

Chalk	**Wax**	**Marble**
Not waterproof	Melts	Is hard/rigid

Shell	**Plant**	**Rock**
Was part of an animal	Living	Has never been alive

Centipede	**Snake**	**Worm**
Has legs/appendages	Not an invertebrate	Lives underground

BRITISH SCIENCE WEEK 2017

CHALLENGES

ANSWER SHEET

BRAINTEASERS

1

The bear was **white** because it was a polar bear. The only place on Earth where a bear can go south, west and north equal distances and end up where it started is the North Pole. The bear would be making a circle!

It could not be the South Pole, as only penguins, and not polar bears, live there.

2

There are two ways to solve this problem:

Option 1

Fill the 3-litre bottle and pour it into the empty 5-litre bottle.

Fill the 3-litre bottle again, and pour enough to fill 5-litre bottle. This leaves exactly 1 litre in the 3-litre bottle.

Empty the 5-litre bottle; pour the remaining 1 litre from the 3-litre bottle into the 5-litre bottle.

Fill the 3-litre bottle and pour it into the 5-litre bottle. The 5-litre bottle now has exactly 4 litres.

Option 2

Fill the 5-litre bottle and pour water from it into the 3-litre bottle until it is full. This leaves 2 litres in the 5-litre bottle.

Empty the 3-litre bottle and pour the 2 litres of water from the 5-litre bottle into the 3-litre bottle. Fill the 5-litre bottle again.

Fill the 3-litre bottle from the 5-litre bottle. Since the 3-litre bottle had 2 litres of water, only one litre is transferred leaving exactly 4 litres of water in the 5-litre jug.

3

Candle

4

You're under arrest

5

Big brother