I ATE SUNSHINE FOR BREAKFAST

Pupil activity sheet

CENTRE *for* INDUSTRY EDUCATION COLLABORATION

This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2021.

"From the moment we wake up to the moment we fall asleep, plants sustain us. From essential activities like eating and breathing right through to the way we choose to spend our free time."

I Ate Sunshine for Breakfast

You will discover the incredible world of plants and the vital role that they play in our lives in *I Ate Sunshine for Breakfast* by Michael Holland, illustrated by Phillip Giordano.

Mathematics challenge

Have you heard of the Fibonacci sequence? This is a pattern which is often found in nature, for example in the spiral of seeds in a sunflower or the pattern of scales on a pinecone. It is made by adding the last two numbers in the sequence together, so we get:
0, 1, 1, 2, 3, 5, 8, 13, 21
(0+1=1, 1+1=2, 1+2=3, 2+3=5, 3+5=8)

Can you work out what the next number in the sequence will be?

You may be surprised how often this pattern turns up. Now you know about it you may spot it in the natural world around you. Perhaps you can take some photographs of any that you find to share in class.

I ATE SUNSHINE FOR BREAKFAST

Pupil activity sheet (continued)

Making a plant

Wouldn't it be fun to make your own plant? For this activity you will need a selection of craft materials and/or junk. You might also like to use modelling clay. You will need to think very carefully about the different parts of a plant and what they look like and why. For example, why do you think roots tend to be long and thin? What material do you think would be best to use to represent roots on your model plant? What do you notice about many flower petals? Why do you think that they are that shape and colour? What could you use to make the best petals for your own flower?

Once you have made your model don't forget to add some labels (have a look on pages 14 and 15 to remind yourself what labels you will need). Once you have finished, perhaps you could take your finished plant into school to show the rest of the class.

Did you know you can make your own recycled paper using a few simple ingredients?

Making paper

Do you know that when you save scrap paper at home and school for recycling you are helping to save trees? This is because the raw material for making paper and cardboard is trees. That is why it is important to use only the paper we need, and to recycle paper wherever possible. You can make your own recycled paper using a few simple ingredients. Once you have had a go, try adapting the recipe. How about adding flower petals or a few drops of food colouring to make designer paper? Or you could incorporate flower seeds; once your recipient has read your letter, they could plant it.

Freezing plants

Have you ever wondered why some plants die back or shed their leaves over winter, while others keep growing without coming to any harm? There is an experiment described in the book which shows you one of the differences between evergreen leaves which survive in winter and the deciduous leaves which are shed by the tree in autumn.

Follow the instructions on pages 56 and 57 and you will see that the effect of freezing is very different on the plants that have adapted to keep their leaves over winter and those that have adapted to survive by shedding their leaves. Can you think of any other differences between the two types of leaf? Can you see how these differences might help the evergreen leaves in more ways to survive during winter?

I ATE SUNSHINE FOR BREAKFAST

Teacher activity sheet

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A-maze-ing plants

Children find it hard to believe that all living things including plants move. This activity is a great way to show them just how much some of them do move when they need to.

On pages 18 and 19 of the book there are instructions for building a plant maze. This is a fascinating activity which will have both children and teachers hooked and is a good opportunity for making observations over time. Groups of children can build their own plant mazes. Afterwards the class can compare how successful the different mazes were. Which design managed to get the plant to make the most changes in direction? Were there any mazes from which the plant could not escape? As a result of their comparisons, have the children got any ideas for how they could improve their mazes? This activity and the discussion around it will help children to understand that plants naturally move towards the light. Support them to understand that this is because they need sunlight in order to manufacture their own food.

I ATE SUNSHINE FOR BREAKFAST

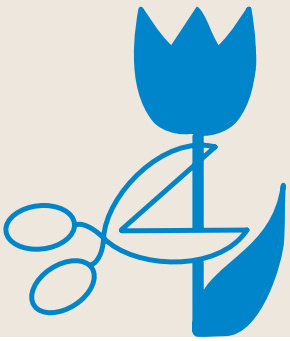
Teacher activity sheet (continued)

Dissecting a flower

On pages 22 and 23 there is a diagram of a flower which shows the parts of a flower and what they are called.

Explain to children that dissecting is when you cut something up very carefully so that you can see all the separate parts. Show them how a flower can be carefully pulled apart and, where necessary, parts of it carefully cut open using scissors so that they can see all of the parts that they can see in the diagram on pages 22 and 23.

Children can then dissect their own flowers. Ask them to use sticky tape to attach the different parts to a piece of paper where they can add labels. Depending upon the flowers chosen you may well find that it is not as easy to see the flower parts as it is in a diagram. For example, daisies and dandelions are actually lots of tiny flowers and the individual parts are too small for you to see. Other flowers are unusual shapes and do not look like the flowers in a diagram which might make their job harder. Flowers with more obvious parts include daffodils, tulips, lilies and alstroemerias.



Take care

Some plants (such as daffodils) are poisonous. They are still safe to use for this activity, but children should be warned never to taste unknown plant materials and reminded to wash their hands after this activity.

I ATE SUNSHINE FOR BREAKFAST

Teacher activity sheet (continued)

We need plants

Children may be surprised when they realise just how many plants they eat over the course of a day and not just the obvious fruit and vegetables that they know. As well as staples such as rice, bread, potatoes and pasta they may be surprised at the origin of other ingredients too such as spreads made from sunflower oil, chocolate from cocoa beans, cornflour in sauces and soya beans in a very wide range of products. For a guided reading session with a difference, you could provide children with a range of packets and containers to read the ingredients on. They can then research any unexpected items (such as guar gum, maltodextrin and citric acid) to find out where they have come from. You could also remind children that even meat and dairy products were produced by animals eating plants.

Follow this discussion up by asking children to walk around the classroom and identify how many of the materials there also come from plants such as paper in books and wooden doors made from trees and some clothing being made from plants such as cotton and bamboo. This activity could culminate in a homework challenge to find out which family can identify most different materials that come from plants.

Career links

Agronomists: advise farmers about how to improve their crop yields. They study soil, water and other factors which affect crop growth including pests and diseases and environmental conditions.

Botanical artists: create observational drawings and paintings of plants. They are often able to show more detail than can be captured in a photograph and the images are very beautiful too. Brigette Gillespie is a botanical artist, recognised by the Royal Horticultural Society for her work. You can see some of her work on her website.

Environmental scientists: study the impact of human activity on the environment, and identify ways to minimise negative impacts, such as air pollution.

INVENTORS

Pupil activity sheet

CENTRE *for* INDUSTRY EDUCATION COLLABORATION

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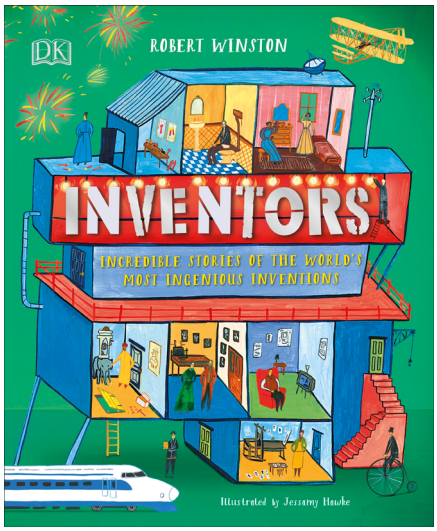


Read fascinating stories about people who have changed the world by making it a more exciting and fun place to live, in the incredible *Inventors* by Robert Winston, illustrated by Jessamy Hawke.

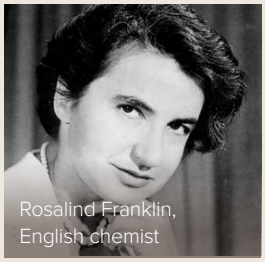
You are an inventor too

Anyone can be an inventor, you just need to let your imagination flourish. Find page 62 and read about how engineers, Ruth Amos and Shawn Brown, created the website and Youtube channel Kids Invent Stuff.

Sketch and label your own invention – you could have a go at the website's monthly challenge or design something of your own.

Inventing is for everyone

Did you know that, throughout history, the ideas of many female inventors were not taken seriously or accepted? It is hard to believe that women were often told that they could not attend scientific courses at universities or receive degrees for studying. Can you think about why this happened? Many incredible women had to fight for recognition and were finally given awards for their pioneering work years later. Here are a few of these famous females. Can you find out more about what happened to them and if their achievements were ever fully recognised?


Rosalind Franklin, English chemist


Eunice Newton Foote, American scientist


Katherine Johnson, American mathematician


Alice Ball, American chemist


Lise Meitner, Austrian-Swedish physicist

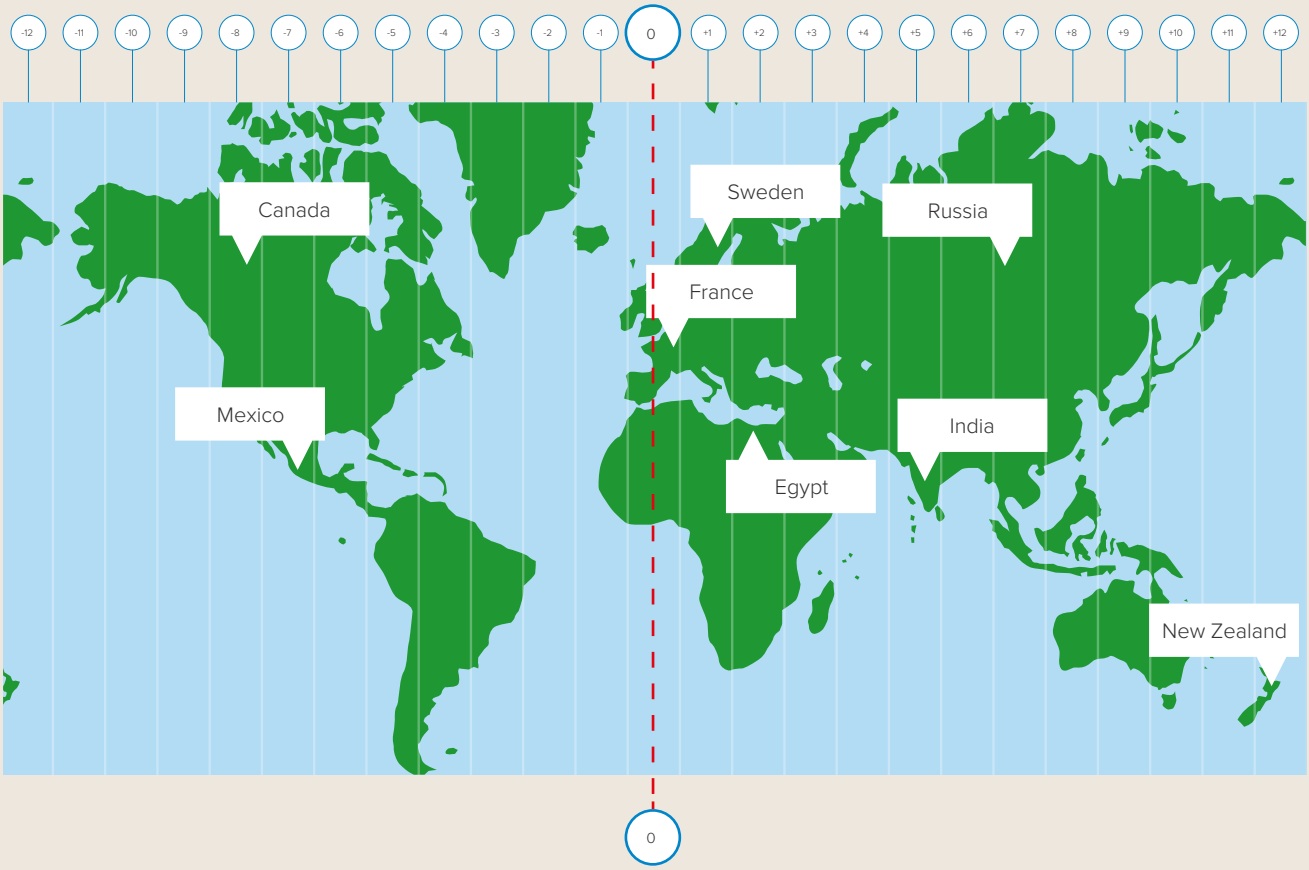
If you want to find out about the most influential women in British science history, take a look at the Royal Society's Women in Science resources.

INVENTORS.

Pupil activity sheet (continued)

Mathematics challenge

Many brilliant inventions come from people like you and me, finding solutions to real-life problems. Read about Sandford Fleming's system to split the globe into 24 time zones, on pages 36 and 37. Sandford decided that time zones would be measured against the time at the Royal Observatory in Greenwich, London, now known as Greenwich Mean Time (GMT).



On the map of the world above, the imaginary red line through Greenwich is called the Prime Meridian Line. Each white line shows the 'time zones' one hour apart. This means that if it is 12pm (noon) at Greenwich, you need to add one hour every time you pass through a zone to the east and subtract one hour every time you pass through a zone to the west.

Using the map, identify the time in each of the labelled countries if it is 10am in Greenwich, London.

Countries like Australia, Russia and the United States of America are so big they are split across several time zones. In these countries, the imaginary lines are usually in remote, unpopulated areas to avoid problems where people are living and working.

INVENTORS.

Pupil activity sheet (continued)

Save your life at sea

Read about Hungarian chemist and engineer, Maria Telkes, on pages 42 and 43. Have you got what it takes to be a 'Sun King or Queen' too? Try creating your own solar still using the instructions below.

1. Fill your jug with water from the tap and add enough table salt so that the mixture tastes salty, like seawater. Do not drink the salty water.
2. Pour the salty water into a large, clear bowl so that it is a few centimetres deep.
3. Place a smaller bowl or pot into the centre of the salty water, keeping the inside dry.
4. Stretch cling film tightly over the top of the large bowl and make sure it is secure.
5. Place a lump of modelling clay, stone, or similar, on top of the cling film so that it pushes the centre down slightly.
6. Leave the bowl in a place where it will get sunshine for most of the day.
7. Go back after an hour and write down what you see.
8. Once you have collected some water in the small bowl, remove this from the larger bowl and taste the collected water. Is it still salty?

What you need:

- A clean, clear mixing bowl
- A smaller bowl or pot
- Cling film
- Jug
- A lump of plasticine
- Table salt
- Water

Inventors are always evaluating and adapting their ideas. Now you have created a solar still of your own, think about what changes you could make to improve it.

INVENTORS

Teacher activity sheet

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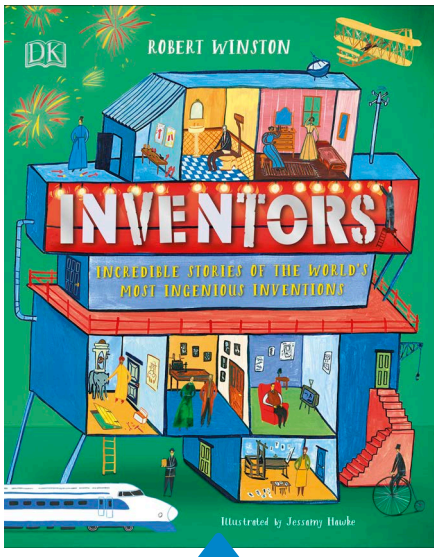
Each activity sheet contains some ideas for experiments to do with your pupils and other experiments that they can try for themselves at home. Additionally, each sheet gives information relating to careers and a maths focus to help pupils understand the importance of mathematics education across the curriculum.



"Each of you reading this book is capable of inventing something."

Do you have what it takes?

The foreword on pages 4 and 5 explains that humans have an exceptional ability to imagine and make a picture in our brains that can help us to create something useful. Discuss how other skills are important for inventing, such as:

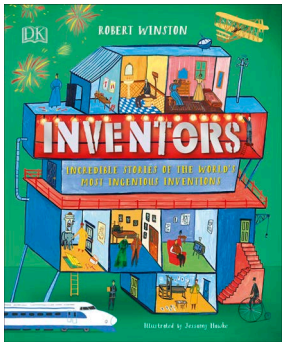
- Persistence – inventors constantly try and try again.
- Accepting failure – inventors understand that failure can be helpful to think about what went wrong and make improvements.

Ask pupils to draw an inventor, considering carefully what they think inventors look like. They should also include a list of skills that make their inventor perfect for the job and explain why.

It will be interesting for pupils to share the drawings and skill sets they have created. Look out for any misconceptions pupils might have about age, gender and race, and reinforce through discussion how inventors come from all walks of life. Pupils could showcase their drawings on display around the school.

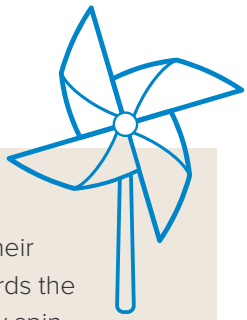
The time is now

Pupils could carry out their own research about an inventor alive today and write a one-page biography about them in the style of this book. One example could be Sarah Gilbert who led a team of scientists at the University of Oxford to invent the Oxford/AstraZeneca vaccine that has been highly effective at stopping people developing Covid-19 symptoms in the UK and many other countries. There are more present-day inventors for pupils to choose from on pages 136 to 139 if they look out for: birth year – present.



INVENTORS

Teacher activity sheet (continued)



Make a make-do windmill

Read pages 60 and 61 with pupils to learn about how William Kamkwamba "harnessed the wind" to generate electricity for the whole village. Explain how many windmills have angled blades connected to a gear box, connected to a generator which produces electricity from the force of the wind.

Challenge pupils to make windmill sails and investigate variables that can affect how fast they spin.

What to do:

1. Measure, draw and cut out a 10cm square of paper.
2. Draw an X diagonally, from corner to corner, and mark the point in the centre of the X.
3. Cut along the X from each corner about halfway towards the centre point. Do not cut all the way.
4. Bend (not fold) each corner towards the centre point and carefully push a split pin through each piece and then through the centre point to secure in place.
5. Push the pin into the rubber end of your pencil. Try spinning the windmill, it should move freely without touching the pencil.

Encourage pupils to go outside to try their windmills. They should hold them towards the wind and observe how fast or slow they spin, try holding them away from the wind and at different angles. Pupils should also try different areas of the playground, holding the windmill high and low, and recording their observations.

Challenge pupils to invent an improved design that allows the windmill to spin faster. They should think about the variables they could change, such as material, sail size, sail shape, length of cut, number of cuts etc.

Remember that inventors plan and draw their ideas to help them think about ways to make them work. Encourage pupils to sketch at least two different ways they think will make the windmill spin faster and explain what changes they have made to the original design.

You will need:


Scissors


Ruler

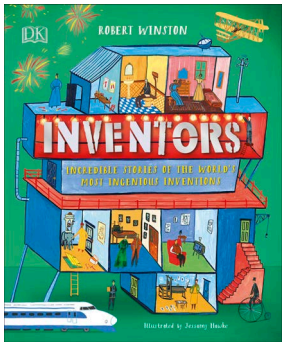

Split pins


Different types of paper and card


Pencil with a rubber on the end

Extra

Have you read the book or watched the film: *The Boy Who Harnessed the Wind*? You could enjoy these in class or at home.



INVENTORS

Teacher activity sheet (continued)

Inventing machines

Discuss with pupils how, over recent years, we have seen huge developments in technology and the impact this has had on inventions. Focus on the robots on pages 134 and 135 and how they are programmed to perform many tasks using sensory inputs and abilities powered by machine learning. To learn more about machine learning, watch this short video featuring Professor Brian Cox and have a go at some activities described in the *Machines of the future* teacher and student pack, created by the Royal Society for the Crest Awards.

Career links

Explain to pupils that the job of an inventor could be considered very similar to that of an engineer. Engineers are always looking to develop or improve things with creative and practical solutions to problems.

Provide pupils with a list of different types of engineers, can they suggest what each type of engineer might do? There are many, many more for them to research too!

- mechanical engineer
- chemical engineer
- civil engineer
- electrical engineer
- aerospace engineer
- environmental engineer

Ask pupils to look back at the list of skills they created in the ‘Do you have what it takes?’ activity. Question which of the skills of an inventor do they think applies to the different types of engineer? And perhaps more importantly, which of these skills do they think applies to themselves?

UNDER THE STARS

Pupil activity sheet

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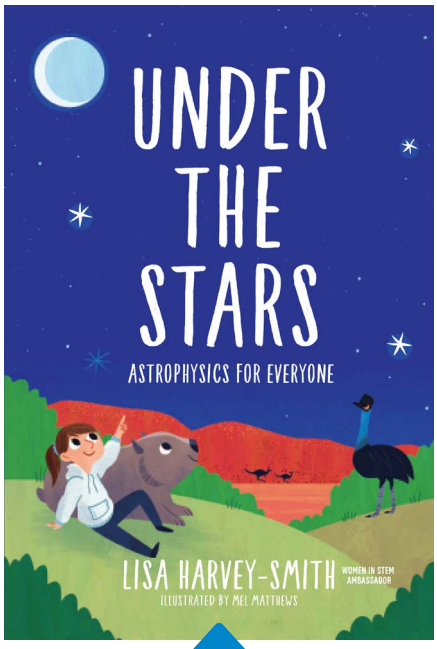


"Think big and enjoy the journey."

You will be taken on an incredible journey through the night sky, our solar system and beyond with *Under the Stars* by Lisa Harvey Smith, illustrated by Mel Matthews.

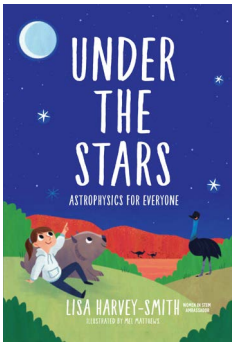
Measurements challenge

It can be very hard to imagine how vast space is. We think of it as full of planets, stars and comets but actually most of it is an unimaginably large empty space. Even in our own solar system the other planets are a long way from each other. To help you imagine the distance you could try making a scale model using toilet paper to represent the distances involved, as this video shows.

The toilet paper model is a great way to help us to understand the huge distances involved. Although, as this video shows, it is difficult to show the relative size of the planets on the same model that you use to show their distances from the Sun. However, you could have a go by adding some fruit to your toilet paper scale to represent the different sizes of the planets.

Name of planet	Fruit to represent relative size of each planet
Mercury	Peppercorn
Venus	Cherry tomato
Earth	Cherry tomato
Mars	Blueberry
Jupiter	Watermelon
Saturn	Large grapefruit
Uranus	Apple

If you really want to blow your mind, have a look at this NASA video which shows just how vast the Universe is.



UNDER THE STARS

Pupil activity sheet (continued)

Starry night

Did you know that there are always stars in the sky? However, we cannot see them during the day because the Sun shines so brightly, and star light is so dim in comparison. Even at night it can be hard to see the stars because of light pollution from streetlamps, headlights and other lights. Even when we can see the stars, they can be hard to identify because there are so many of them. Fortunately, it is possible to download free apps such as SkyView® Lite for both iOS and Android devices. It will then show you the position of all the stars in the sky above you whether it is day or night.

Can you find the following?

The North star

Mars

Jupiter

International Space Station

Hubble Space Telescope

What else can you find?

Solar eclipse

Did you know that the Sun is exactly 400 times further away from the Earth than the Moon is? It is also exactly 400 times larger than the Moon. This means that when the Moon passes between where we are standing on the Earth and the Sun, the Moon completely covers our view of the Sun and it goes dark, even in the middle of the day. Why don't you have a look at this video of professor Brian Cox watching a solar eclipse? After watching it you could experiment to see how far away from your face you would have to hold your hand so that it completely covered a large object (such as a house) in the distance. Can you find the distance needed so that your hand is exactly the same size? Do you need to move it nearer to you or further away to make your hand seem smaller in relation to the large object?

Take care

Make sure that you never look directly at the Sun.

UNDER THE STARS

Teacher activity sheet

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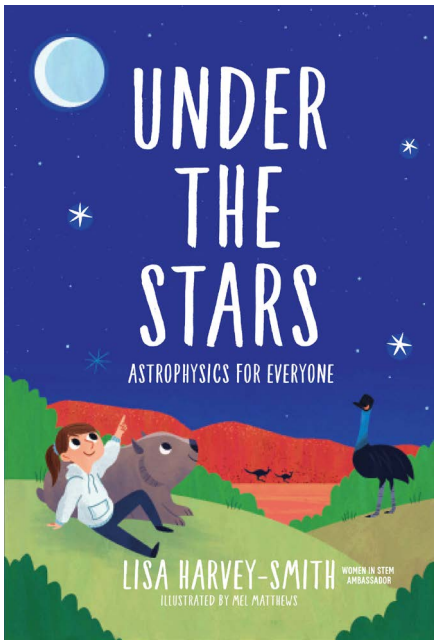


Night and day

Children can find it hard to believe that it is the rotation of the Earth rather than the movement of the Sun that creates night and day. Help them to understand this by using a torch and globe. Ask a child to 'be the Sun' and steadily shine the torch towards the globe. As you slowly spin the globe ask the children to tell you which part of the world is experiencing daytime and which part is experiencing night. Try sticking a small figure to the surface of the globe in the part of the world where you live and discuss when they will be having breakfast, lunch and tea.

You can also use the same equipment to demonstrate the seasons by demonstrating that the part of the world tilted towards the Sun receives more light than the part which is tilted away which receives less light and is consequently colder.

While you have got the torches out you might also like to look at this video with Brian Cox and Sarah Eames from Sandfield Close primary school for some ideas about how to help children to understand more about shadows.

Take care

Ensure children know that they should not look directly into a torch.

UNDER THE STARS

Teacher activity sheet (continued)

All of the colours of the rainbow

Children may be amazed to learn that white light is made up of lots of different colours. This is why we sometimes see a rainbow when it has been raining. Rainbows are caused by sunlight shining through water in the atmosphere. The different colours of light travel through the water in slightly different directions so that they are split into the familiar order of red, orange, yellow, green, blue, indigo and violet. Scientists call this splitting of colours dispersion.

If you have some glass prisms in school you can show children how they can recreate a rainbow by using the light from the Sun, or from a torch, to shine through a prism onto a piece of plain white paper. They will need to keep moving the prism around and changing angles until they can see a rainbow on the paper. If there are no prisms in school, children can still make rainbows. On a sunny day, with their back to the Sun, they will need to spray water (from a hosepipe or spray bottle) in front of them. As the Sun shines through it a rainbow will appear. This works best earlier or later in the day when the Sun is relatively low.

Take care

Ensure children know that it is important not to look directly at the Sun.

Extension activity

Discuss the ethical implications of fantastically expensive holidays while there are thousands of people on Earth who cannot afford enough food. Or the environmental impact on our beautiful living planet of burning huge amounts of fossil fuel in order to visit space.

Space tourism

Space exploration companies have highlighted future opportunities for space tourism, and recent unmanned missions to Mars show that the sky is no longer the limit. Challenge your children to think about a future where space tourism is commonplace. They could imagine themselves as tour operators or travel agents selling holidays in space. What might the holidays entail? How would they advertise them?

Ask pupils to research conditions on each planet and distances from their Earth. Encourage them to think about how likely it is that we could ever visit each planet. What will space tourists need to consider before they travel? Although it is very unlikely that we will ever get to visit far away planets in our lifetime you can find out more about some of them on NASA's exciting website.

Career links

Did you know that NASA recruits between 500 and a 1000 people a year to work in a variety of roles? You can find out more here. Possible careers include

- **Aerospace Engineers** design, build and maintain planes, spacecraft and satellites.
- **Life Scientists** study humans, animals, plants and other living organisms including assessing the impact on astronauts of spending time in space.
- **Mathematics Modellers** use mathematics to predict what will happen when lots of different factors come into play. For example, when sending a rocket to the Moon they have to take into account the speed of the rocket, the changing effect of gravity, the rotation of the Earth and the movement of the Moon. A famous mathematician that worked for NASA was Katherine Johnson.

100 THINGS TO KNOW ABOUT SAVING THE PLANET

Pupil activity sheet

CENTRE *for* INDUSTRY EDUCATION COLLABORATION

This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2021.

You will love reading about a wide range of ideas, approaches, technology and tools to help fix the planet crisis in *100 Things to Know About Saving the Planet*, by Rose Hall, Jerome Martin, Alice James, Darran Stobbart, Alex Frith, Eddie Reynolds, Lan Cook, Matthew Oldham and Tom Mumbray, illustrated by Federico Mariani, Parko Polo, Dominique Byron, Dale Edwin Murray, Jake Williams and Ollie Hoff.

Beech today, oak tomorrow

Read pages 72 and 73 of the book to learn how the right types of trees need to grow in the right environments. Ask an adult to join you to explore your garden, street or local park to find out which trees are 'on your doorstep'.

You might need some secondary sources of information to help you identify the trees by examining the trunks, branches and leaves. The Woodland Trust has some brilliant resources if you search for tree spotter sheets, ID sheets or iDials.

Think about how you are going to record and present your findings in a clear and interesting way.

One step further: create your own biodiversity map

Go to pages 8 and 9 of the book to read about megadiverse countries across the world which are home to a huge variety of plants, animals and other living things. You could extend your tree survey by asking an adult to accompany you on your own 'mini field-trip' with the aim of discovering and identifying a wider range of living things in your garden or neighbourhood, or further afield to a woodland or beach.

There are some really useful mobile apps you could download to help you to identify unknown species. You could try:

- Seek by iNaturalist
- Woodland Trust British tree identification
- Leaf Snap
- iBird UK & Ireland

Take photographs, make drawings and record the information you collect as a 'biodiversity map' showing what you have found and where. Would you say you live in a megadiverse area? Is there anything you can do to help encourage and protect your natural habitat to ensure survival of the things that live there?

100 THINGS TO KNOW ABOUT SAVING THE PLANET

Pupil activity sheet (continued)

Plastics and recycling

Make a list of the objects you use every day that are made from different types of plastic. How many of these do you throw away? How many of these do you re-use or recycle? Look on the base or label of different plastic items around your home. Can you find the recycling symbol that looks like this?

To help identify which plastic an object is made from, they often have letters or a number (or both) printed on the bottom of the object. Some common examples are:

Look at your plastic items to locate this information and try to work out, or research, what the abbreviations or numbers might mean. Can you sort and group your plastic items according to plastic type? Can you find out which materials and types of plastic can be recycled near to where you live?

Check out this Plastics Challenge by Practical Action. There is a brilliant guide to help you to carry out the activities at home, including investigating plastics and then producing a new product by reusing plastic.

For an investigation linked to microplastics, scroll down to the Which washing product? activity on CIEC's website.

Powerful art

Turn to page 55 to read about Lorenzo Quinn's thought-provoking sculpture in Venice, Italy, to get people really thinking about their impact on the planet. A similar example is the inspirational plastic fish sculptures to discourage people from leaving plastic bottles at Botafogo beach in Brazil.

Try an internet search of 'sustainable art' to find out more about artists, such as Nek Chand, from India, who created the famous 'rock garden' using only waste, discarded objects and stones. Think about how you could utilise waste in an eco-friendly manner to create something that would inspire millions of others towards looking after our planet. Draw a sketch of your designs and ideas.

Mathematics challenge

Read about energy vampires on page 20 and 65.

Many electrical appliances are rated in Watts to indicate how much energy they will use. One thousand Watts (W) is equal to one kilowatt (kW).

Convert the following W to kW:

1500 W
light hairdryer

800 W
microwave

60 W
light bulb

We measure the energy used by an electrical appliance using a unit called kilowatt hours. We can calculate this if we know the power rating of the appliance (in Watts), then convert this into kilowatts (kW) and multiply this by how long the appliance has been used for (hours).

ENERGY USED (KWH) = POWER (KW) x TIME (HOURS)

Try calculating the cost of electricity for:

Electrical appliance	TV	Charging an iPhone	Xbox
Power (W)	60 W	18W	200W
Power converted to kW			
Time used (hours)	5	11	4
Energy used (kWh)			
Cost at 16p per kWh			

Try adding these prices up over one week, one month or even a year to find out how much the electricity you are using might be costing! Is there anything you can do to 'slay the energy vampires' in your home?

100 THINGS TO KNOW ABOUT SAVING THE PLANET

Teacher activity sheet

CENTRE *for* INDUSTRY EDUCATION COLLABORATION

This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2021.

Each activity sheet contains some ideas for experiments to do with your pupils and other experiments that they can try for themselves at home. Additionally, each sheet gives information relating to careers and a maths focus to help pupils understand the importance of mathematics education across the curriculum.

"There isn't one easy way to fix the climate crisis and the other problems facing the planet. But it can be done – and everyone has a part to play."

100 Things to Know About Saving the Planet

Why does the planet need saving?

Page 4 of this book introduces pupils to factors contributing to the 'climate crisis' otherwise known as 'climate change'. A great way to take their understanding further is to download and use the Royal Society's classroom resources, *What do you want to know about climate change?* Primary and younger secondary pupils can have a go at answering the ten 'basic' questions and discuss the range of answers provided, based on the latest evidence available to scientists.

In 2021, students aged 5 to 14 across the UK were given the opportunity to ask their questions to Professor Brian Cox and a panel of science experts. The questions were grouped into six areas and the resulting *Your planet, your questions* videos can be watched together. Pupils could consider their own questions and compare them with the ones asked in this exciting project – they make fascinating viewing and can be used as a discussion starter or to extend pupil's knowledge and understanding of climate change.

As an extension to this, you will find a range of activities in CIEC's publication, *Sustainable Stories and Solutions for Our Planet*, whereby practical science investigations are linked to real stories from industry.

100 THINGS TO KNOW ABOUT SAVING THE PLANET

Teacher activity sheet (continued)

Make a pledge tree

It is important for the whole school to unite and understand that everyone working together can make positive changes. Make a pledge tree in your classroom, main hall or entrance to the school. Pupils, teachers and visitors could be encouraged to write down what they will do to alleviate problems facing the planet. Page 122 of the book lists ten everyday actions that will provide some inspiration to get you started. You and your class could revisit the tree throughout the year to reflect upon your actions.

You might consider joining the national campaign Let's Go Zero 2030 and join other schools working to become 'carbon zero' by 2030. The pledges you are making will transform your school and help safeguard the planet for future generations.

Cities of the future

Discuss with pupils the estimate of nearly 70% of the world's rapidly growing population will live in cities by 2050. Read pages 100, 116 and 117 with your class to find out about how scientists, engineers and city planners are developing ways to make cities cleaner and more energy efficient.

Pupils could work in small 'expert groups' to research examples of this further, which might include:

- Kinetic paving
- Electric buses and taxis
- Smart windows
- Vertical forests
- Sponge cities
- The twenty-minute neighbourhood

You could take this even further by exploring the future world of 'animate materials' which are researched and created by scientists to sense, move, change shape, and adapt to their environment. The Royal Society has produced *The future of stuff* factsheet and resources to help pupils gain an insight into a future in which roads can self-heal and 'living buildings' can harvest carbon dioxide to generate power and purified water.

Encourage pupils to work as a materials scientist to design a new material in order to solve a real-world problem. Why not create a display of your pupils' ideas?

#2050challenge

Explain to pupils that the #2050challenge is a social media video campaign focused on real solutions to helping the planet, explained by the scientists and people who are shaping them. Watch a selection of 70-second videos, posted by the Royal Society and others, on Twitter and popular social media platforms using the hashtag #2050challenge.

Encourage pupils to try taking the #2050challenge themselves. Challenge them to explain a climate change or biodiversity problem in 20 seconds and propose a solution in 50 seconds.

For further information on the project and how to submit your completed videos, go to #2050challenge on Twitter or visit the Royal Society website.

100 THINGS TO KNOW ABOUT SAVING THE PLANET

Teacher activity sheet (continued)

Save our seeds

You could use the seeds you have collected during mini field-trips in August to October, and begin to create your own seed collections, using inspiration from the Svalbard Global Seed Vault in Norway, described on page 91 of the book.

You will need:

- Envelopes or film canisters (or similar)
- Ongoing collection of seeds
- Newspaper
- Shoe box

What to do:

There are different ways to collect different types of seeds:

- as flowers finish blooming, they leave seeds on the plant so you can collect the seeds they make
- watch for wild fruits to ripen before removing seeds from the fruits
- wait for seeds such as sycamore 'spinners' to fall, and acorns from oak trees to drop
- let pine cones dry indoors then pull out the scales and look for seeds
- wear socks over your shoes and walk through weeds or a meadow so that seeds become stuck to your socks

Take all seeds indoors and let them dry on newspaper before sorting them and storing them in different containers. If there are any seeds you cannot identify, try using the seed spotter sheet or seed iDial from the Woodland Trust's website.

If pupils still have some 'mystery seeds' that they are unable to identify, try growing them the following year.

Don't forget to label each container for future reference.

Different collections of seeds can be preserved safely in a 'shoe box vault'.

There are some brilliant videos on the internet you can watch and 'take a tour' inside a seed vault. Try searching for: Inside the Doomsday Seed Vault or Journey of a Seed – Kew Gardens Millennium Seed Bank.

Career links

If your pupils have enjoyed learning about cities of the future and want to know more about careers associated with environmental planning and innovation, why not suggest the following:

- **Climate scientist** – study the influences on the Earth's climate over time and how these might affect it in the future.
- **Sustainability scientist** – collect environmental data and develop plans to prevent, control, or fix environmental problems, such as land or water pollution.
- **Materials scientist** – study and analyse the chemical properties and structure of different man-made and natural materials.
- **Environmental or urban planner** – oversee projects such as housing and transportation for their potential impact on the environment.

AGENT ASHA: MISSION SHARK BYTES

Pupil activity sheet

CENTRE *for* INDUSTRY EDUCATION COLLABORATION

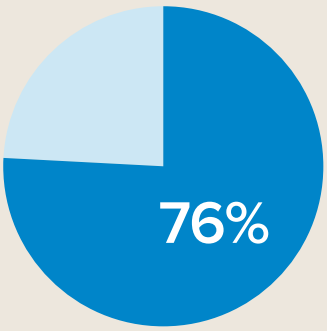
This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2021.

"Question everything and think for yourself."

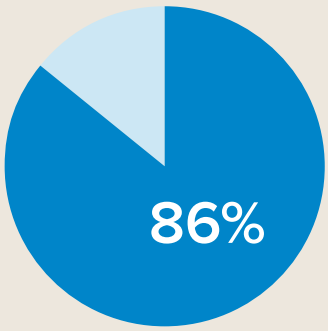
Delve into the exciting world of algorithms and technology with *Agent Asha: Mission Shark Bytes* by Sophie Deen, illustrated by Anjan Sarkar.

Measurements challenge

Pie charts are a useful way of clearly representing data. You can see that whilst fewer children in class A like science, there are actually a greater proportion of children in this class, than in class B, who like science.



Class A 24/28 children like science



Class B 25/33 children like science

Use pie charts to represent the data below, what does it tell you about how many children in each class would like a career in science?

Class	Number of children in class	Number who would like a science career
X	30	17
Y	32	17
Z	29	19

Can you find some real data, perhaps from someone's fitness tracker, and have a go at representing it visually to make it easier to understand?

AGENT ASHA: MISSION SHARK BYTES

Pupil activity sheet (continued)

Mathematics challenge

At the start of each chapter there is a message written in morse code. You could use the morse code alphabet shown on page 89 (or here) to decode the messages. Once you have read them, have a go at writing a message for a friend. You could even try tapping it out with short sharp taps for the dots and longer taps for the dashes. It takes a bit of practice to learn to understand morse code in this way, but it means that you can send messages even when you can't see what someone has written, for example if someone is in the next room.

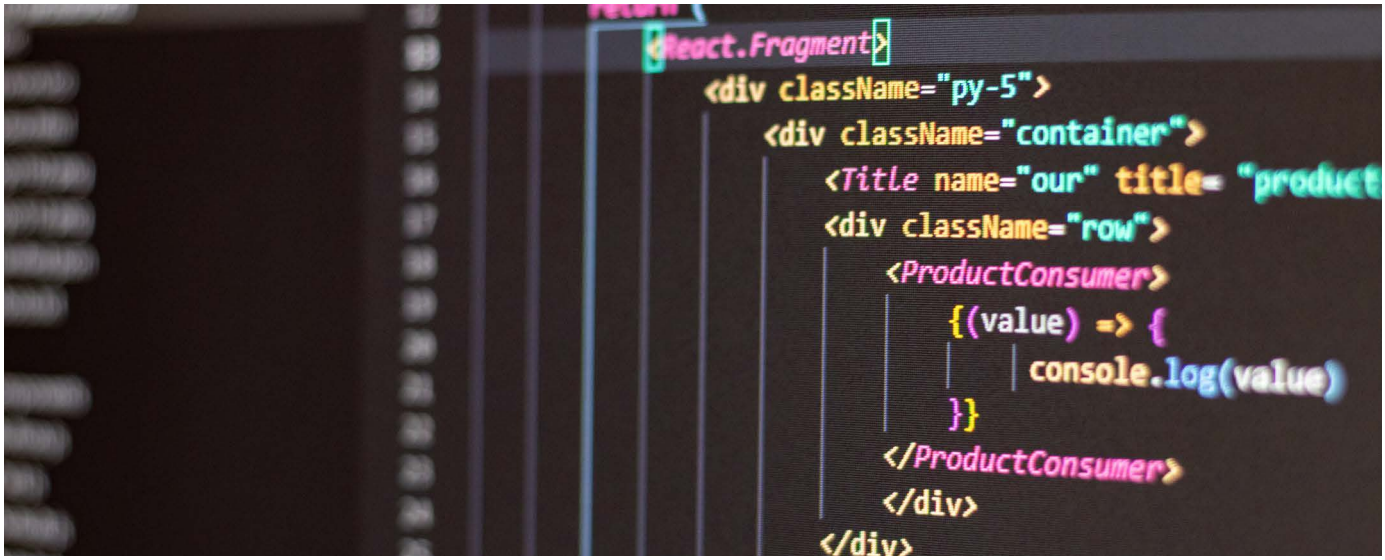
Programming

Asha is a whiz at programming; she must have practiced a lot to do it so quickly and confidently. Scratch is a free computer program where you can learn how to code and practice your skills. If you keep practicing, you will soon be as good as Agent Asha and maybe you will be getting a call from the Children's Spy Agency.

Writing algorithms

Algorithms are sets of very detailed instructions given to a computer. You have to be very precise when you give instructions to a machine because it will do EXACTLY what you tell it to do. If you don't describe the simplest set of actions in tiny and very accurate steps it can go horribly wrong, as can be seen when Tumble instructs Asha how to make a jam sandwich on pages 15 and 16 (with very funny results).

Have a go and see if you can do a better job than Tumble to write some precise instructions for a friend or family member to make a sandwich or paint a picture. Warning: things might get a bit messy if you make a mistake in your instructions. If anything does go wrong because of a mistake in the instructions given to a computer, it is called a 'bug'. Rewriting the instructions so that they are more accurate is called 'debugging'. Now that you have tried out your instructions do you need to debug them?



AGENT ASHA: MISSION SHARK BYTES

Teacher activity sheet

CENTRE *for* INDUSTRY EDUCATION COLLABORATION

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The unbelievable truth

If children are to use technology as a tool rather than being manipulated by it, it is imperative that they approach what they read with a healthy dose of scepticism and know how to fact check. Page 87 addresses the thorny issue of fake news and the importance of children thinking for themselves rather than believing everything that they read. Challenge the children in your class to write two short paragraphs, one that contains a true fact and one that is fake news. The more unusual the 'true fact' the harder it will be for their classmates to separate fact from fiction.

The paragraphs can then be displayed around the classroom and children asked to vote for the ones they believe to be true and those they believe to be false. Encourage children to use secondary sources to support their choices. For more ideas about how to verify information that they encounter, children may also like to look at the activities linked to *Cats react to science facts* from last year's book prize.

AGENT ASHA: MISSION SHARK BYTES

Teacher activity sheet (continued)

PMI: What if there was no internet?

Agent Asha is called to action because there has been an attack on the internet which means that no one is able to rely on it anymore which is causing a lot of problems.

Plus, minus, interesting (or PMI) can be a productive way to organise discussions. Children are given a statement (in this case, 'What if there was no internet?'). In small groups they are then given several minutes at a time to discuss and list, firstly, what would be good (or positive) about this situation, then what would be bad (or minus) about it and lastly what might be an interesting or unexpected outcome.

This activity tends to get better results if children are given plenty of time to consider each aspect before moving on to the next; giving them a couple more minutes after they seem to have run out of ideas often leads to the most creative suggestions.

Finding out more about data science

Having had this discussion, point children to the information towards the back of the book which shows that, worldwide, only about 49% of the population have access to the internet. In a world that relies so much on technology how do they think that these people will be affected?

Children could also follow this activity up by going home and interviewing older members of their family about their memories of what life was like before the internet was invented.

Teachers from the Royal Society network of schools have produced ideas for lesson plans related to data science and machine learning for KS2 children. There is also a similar resource for use with KS1 children.

Career links

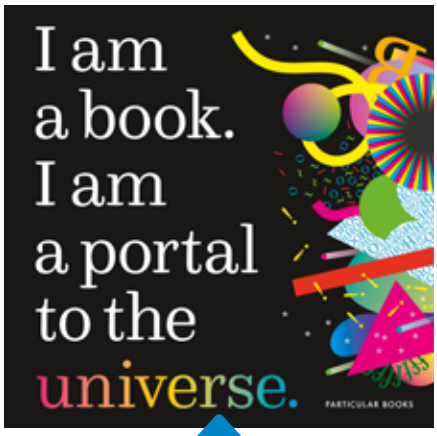
- **Graphic designer:** Some graphic designers analyse computer data and translate this into a pictorial form which makes it easier for people to understand, combining coding and art skills.
- **Drone pilot:** Drone pilots operate drones in a variety of situations, for example in enemy territory for the military or for aerial filming. Increasingly, drones are also being used for the delivery of goods.
- **Code breaker/data scientist:** GCHQ employs people who are good at languages, mathematics and solving puzzles to intercept and interpret enemy messages. These are often written in complicated codes which need to be broken before they can be read.

The above suggestions all need science qualifications. You could show children this Royal Society animation to help them understand just how many other careers benefit from studying science.

I AM A BOOK. I AM A PORTAL TO THE UNIVERSE.

Pupil activity sheet

This is one of a series of six activity sheets to use alongside the books which have been shortlisted for the Royal Society Young People's Book Prize 2021.



"With my measurements, I will show you the wonders of the cosmos."

I am a book. I am a portal to the universe.

Prepare to be amazed as the wonders of the world are unleashed in *I Am a Book. I Am a Portal to the Universe.* by Stefanie Posavec and Miriam Quick.

Hello I am a book

Choose a favourite book of your own and write an introduction for a friend:

"I have (number) pages, bound with thread.

Each (shape) page is (measurement) high, (measurement) wide and (measurement) thick.

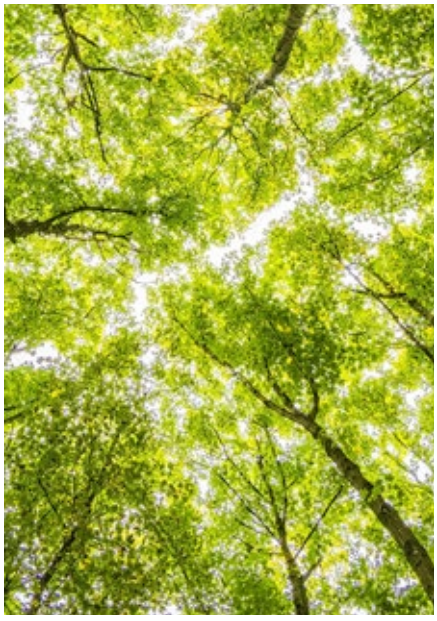
Words and images are printed on my pages using (number) inks.

My text has been set in (typeface name).

I weigh about (measurement) grams.

Just an ordinary book. Or so you think."

Can you add any additional properties to help others 'get to know' your book?



There's a forest within these pages

The pages of this book are made from half a kilo of wood, sourced from hundreds of trees. Do you know exactly how paper is made from trees?

You could ask your teacher to register on the Explorify website and share this activity with you. Watch the short video and try the 'what's going on?'

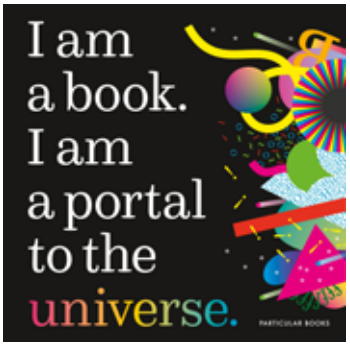
Think about:

Was there anything that surprised you about how paper is made?

Why do you think there are different ways to make paper?

Why is it important to plant more trees once they have been chopped down to make paper?

How many different uses for paper can you think of?



I AM A BOOK. I AM A PORTAL TO THE UNIVERSE.

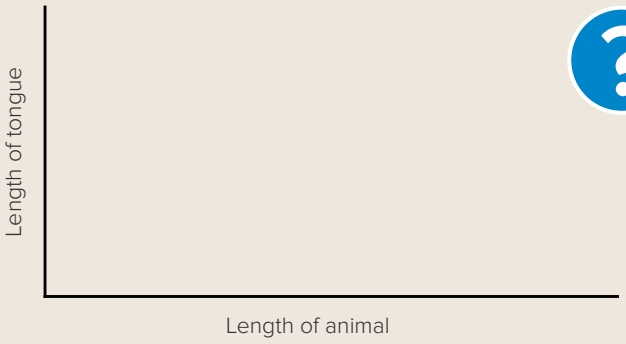
Pupil activity sheet (continued)

Now it's time to test your tongue

Find the page early in the book about tongue length. Carry out some research of your own about the tongue length of other animals. Try to include mammals, birds, fish, amphibians, reptiles and insects. Use a ruler to draw lines from one edge of a piece of page to compare lengths. Remember to label each line with the name of the animal.

You could carry out your own investigation to find out: Does the biggest animal have the longest tongue?

For the list of animals you have researched, use books and the internet to find out the length of the animal from 'tip to tail (if they have one!). Record your results by putting a dot in the scatter graph below. You will need to add your own scale based on the lowest and largest numbers you have gathered.



Can you see a pattern in your results? A diagonal line going upwards or downwards could mean a link between the two variables. A 'mish mash' of dots indicates that animal size does not affect tongue length.

Take it further

Why do animals have tongues? Why are some tongues longer than others? Which animals have no tongue and why? Which animals have more than one tongue and why?

Measurements challenge

The world has so many names for different amounts. Do you know what the following words mean?

mega kilo nano

tera milli giga

micro centi googol

1. Put these words in order from smallest to biggest.
2. What unit of measurement would be used for a billionth of a metre?
3. What unit of measurement would be used for a million litres?

I AM A BOOK. I AM A PORTAL TO THE UNIVERSE.

Teacher activity sheet

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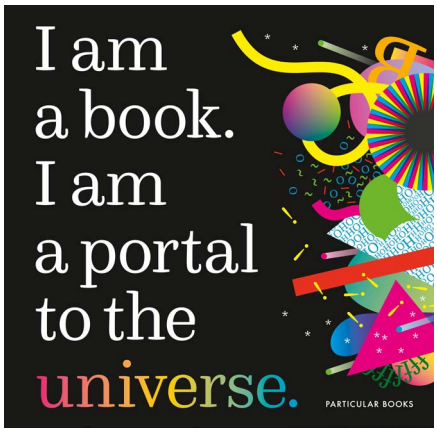


Delve into DNA

Read the pages describing how all living things are made of cells and, hidden inside every cell, are tiny strings of code called DNA. Explain to pupils that DNA is the material that carries all the information about how a living thing will look and function, like a set of instructions. Share with pupils that 60% of human DNA is the same as that of a banana! To help create an image of what it looks like, try this teacher demonstration to extract some DNA from a banana.

You will need:

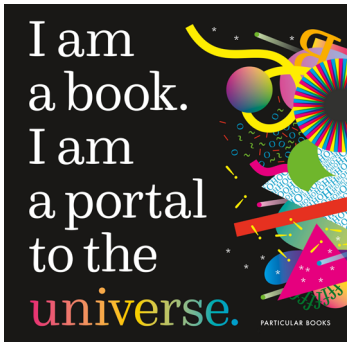
- one banana
- one fork and one teaspoon
- two small bowls
- washing up liquid
- salt
- 100 ml water
- washing-up bowl half filled with water at 60°C
- 100 ml of ice-cold alcohol*
- fine sieve
- glass beaker or clean jam-jar
- paper clip
- safety glasses

*(Isopropyl alcohol can usually be found at the pharmacists. Make sure you put it in a freezer for at least 30 mins before starting the experiment.)

Turn over for instructions

Take care

Isopropyl alcohol must only be used following safety rules, which are not advised in primary school, therefore, this activity is recommended as a teacher demonstration only when working with younger pupils.



I AM A BOOK. I AM A PORTAL TO THE UNIVERSE.

Teacher activity sheet (continued)

What to do:

1. Remove the skin and mash the banana in a bowl using a fork.
2. Make the 'extraction buffer' by mixing one teaspoon of washing up liquid, one teaspoon of salt and 100ml water in a separate bowl.
3. Add the mashed banana to the extraction buffer and mix thoroughly, without making too many bubbles.
4. Half fill a washing-up bowl with water at 60°C. Carefully place the bowl containing the banana mixture to float on the water for 15 minutes.
5. Pour the banana mixture through a fine sieve into a glass. This will remove all the solid material that you don't want and leave a clear(ish) liquid.
6. Slowly, drop by drop, pour the ice-cold alcohol down the inside of the glass. Aim to produce a layer of alcohol floating on top of the banana liquid.
7. Observe a fluffy white substance appear at the top of the mixture. This is your banana DNA! Use a bent paperclip as a hook to slowly draw the DNA out of the solution.

You could try extracting the DNA from other types of fruit, strawberries and kiwi work particularly well too.

How loud is 100 decibels?

Ask pupils if anyone knows of a unit to measure volume of sound - how loud or quiet a sound is. Discuss with pupils that sound is measured in decibels (dB) using a sound meter.

Use your school data logger or download a free sound meter app, such as Decibel or Sound Meter, for pupils to measure the volume of different sounds around the school. Can they predict which sounds will be greater than, less than and the same as 100 decibels? Can they close the book as hard as they can to produce a sound of exactly 100 decibels? How will they record and present their findings?

Career links

Turn to the back pages of the book and read about the amazing authors. Discuss with pupils how artists and designers often incorporate science into their work, just as journalists and researchers can have successful careers writing about science. It is important for pupils to understand that many varied careers require high levels of scientific understanding in order to communicate data and ideas in a range of interesting ways.

Pupils could find out more about the following careers:

- **Science writer** – you will need to understand scientific information, theories and practices, and you should be able to write in clear, concise and accurate language that can be understood by the general public.
- **Science journalist** – you will report on scientific news for the media and take on a more investigatory, critical role.
- **Science researcher** – you could work for government laboratories, environmental organisations, specialist research organisations or universities.