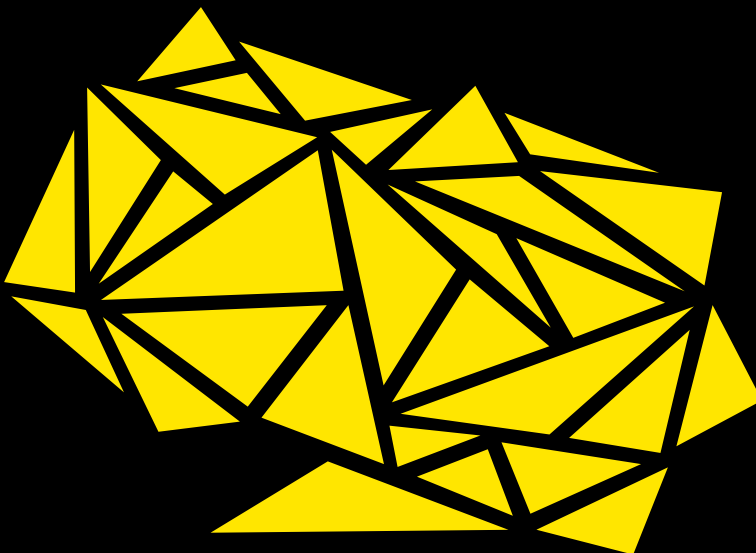




# CAMBRIDGE FESTIVAL

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# WELCOME

WE BELIEVE THAT IT'S NEVER TOO EARLY TO BEGIN INVESTIGATING THE WORLD AROUND US. THAT'S WHY WE ARE BRINGING YOU YOUR VERY OWN MAGAZINE PACKED FULL OF EXCITING ACTIVITIES TO HELP YOU EXPLORE OUR WONDERFUL WORLD.

Across its pages you can travel to the moon, make your own perfume, write a secret message and learn to tell the time with water! And lots more besides!

The Cambridge Festival, which offers over 350 free online events, runs from the 26 March – 4 April 2021.

The Festival is brought to you by the University's Public Engagement team, who are passionate about sharing the world-changing research which is taking place in Cambridge.

We would love to see what you create from these activities. Please share with us by emailing me at **[cambridgefestival@admin.cam.ac.uk](mailto:cambridgefestival@admin.cam.ac.uk)** or on social media!

Looking forward to hearing from you.



Sue Long  
**Public Engagement and Festivals Officer**

PS to make sure everyone stays safe, why not try these activities with an adult so they can help and enjoy the fun too?

 @Cambridge\_Fest  @CambridgeFestival  @CamUniFestivals  [www.festival.cam.ac.uk](http://www.festival.cam.ac.uk)

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**The University of Cambridge Museums is a consortium of the eight University Museums and the Cambridge University Botanic Garden.**

From Egyptian coffins and giant whales, to dinosaurs and Greek gods, together, we represent the UK's highest concentration of internationally important collections outside London. With more than five million works of art, artefacts, and specimens, the collections span four and a half billion years.



UNIVERSITY OF  
CAMBRIDGE

Department of Engineering

# MOON QUIZ!

TEST YOUR LOONEY KNOWLEDGE WITH OUR MOON-THEMED QUIZ...

**Some questions are serious, some are more light-hearted.  
How much do you know about our natural satellite?**

1. What does 'gibbous' mean?

2. What was the date of the first Moon landing?

3. Who was the first human to step onto the Moon?

4. How many people have walked on the Moon?

5. How many of them were either the oldest or the only child in their families?

6. What was the size, on the Richter scale, of the largest moonquake ever recorded?

7. What is the maximum lunar daytime temperature?

8. What is the minimum lunar night time temperature?

9. How many Clangers are there? Who are they?

10. How do you pee in space?

11. Which soft drink was used in eating and drinking experiments by Gemini astronauts preparing for travel to the Moon?



# NAME THAT MOON!

Add these names to this Moon image.  
Say if the thing you are naming is a crater (C) or mare (M).

- a. Copernicus
- b. Crisium
- c. Humorum
- d. Imbrium
- e. Plato
- f. Serenitatis
- g. Stevinus
- h. Tycho

1. C/M

2. C/M

3. C/M

4. C/M

5. C/M

6. C/M

7. C/M

8. C/M



IMAGE © NASA

**Answers:** 1. A gibbous Moon is more than half showing but not full; 2. 20<sup>th</sup> July 1969; 3. Neil Armstrong; 4. 12; 5. 12; 6. 5.5; 7. 127°C; 8. -173°C; 9. 8 (Granny Clanger, Major Clanger, Mother Clanger, Small Clanger, Tiny Clanger, three other Clangers, two males with different coloured hair and a female wearing blue, also appear in the original episodes, but they have been dropped for the 2015 revival); 10. Very carefully! 11. Tang; 12. 1 - e/c, 2 - d/m, 3 - a/c, 4 - c/m, 5 - f/m, 6 - h/c, 7 - b/m, 8 - g/c.

Museum *of*  
Cambridge

# BOREDOM BUSTERS!

**DAYS CAN SOMETIMES BE COLD AND DARK DURING THE WINTER,  
BUT THAT'S NO EXCUSE TO STOP HAVING FUN!**

**READ ON FOR SOME FABULOUS GAMES TO PLAY INDOORS  
AND OUTDOORS.**

FOLK MUSEUM & SHOP ➔



# ANIMAL RIDDLES

This game is to be played with two people or more. One of you chooses an animal, without telling the others. The rest of the players have to ask questions to find out what the animal is, but the questions can only be answered with YES or NO. Make sure your questions are specific!

## Example questions:

- Does it fly? Does it walk? Does it swim?
- Is it a carnivore? Is it a herbivore?
- Is it a mammal? Is it a reptile? Is it a bird?
- Is it brown? Is it spotted? Is it striped?

Can you guess the animal asking these and other questions?

# TREASURE HUNT IN THE WILD

Are you good at finding things? Test your skills by trying to find everything that's on the list while you are outdoors.

1. a small dog
2. a building with a blue door
3. a baby pram
4. three pigeons
5. two squirrels
6. a red flower or fruit
7. a person wearing something green, and a person wearing something yellow
8. a rock with an unusual shape

# STORYTELLING CHALLENGE

You can play this game on your own or with others. If you play on your own, you can pick three words at random from a book or magazine. If you are playing with others, one of you will be coming up with a story (the storyteller), and the others will be supplying at least three words for the storyteller, that they must use to tell their tale.

These words can be anything, but it's better if they are things or animals (like cake, or bear), or things you can do (like run, or laugh).

The storyteller then has to start telling a story that has all those words in it, and they can be said as many times throughout the story as needed.

After the story is finished, it is time for someone else to be the storyteller, and for the rest of the players to provide the words. If you want to make this more interesting, add a timer and give each storyteller five minutes only to tell their full story.

What's the best story you can come up with?



The  
Fitzwilliam  
Museum  

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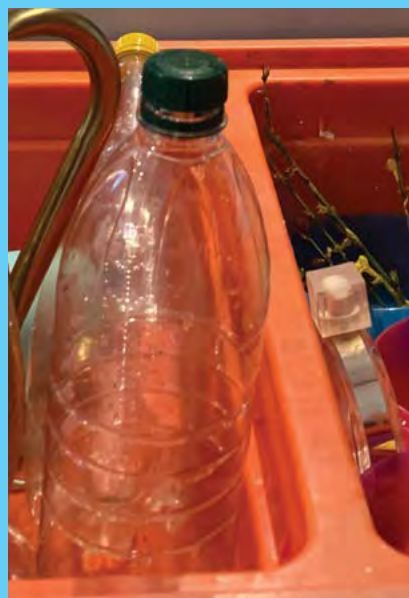
CAMBRIDGE

# MAKE YOUR OWN PERFUME



In ancient Egypt, some women wore head cones of perfumed fat that melted over their heads in the heat and acted as a sort of ancient, fragranced hair gel.

This activity is inspired by our special exhibition *Scent from Nature*, on display at the Fitzwilliam Museum. For more details, please visit our website [fitzmuseum.cam.ac.uk](http://fitzmuseum.cam.ac.uk)





# Δ HISTORY OF PERFUME

Perfume has been around since ancient times. The word perfume comes from the Latin per fumum, which means 'by means of smoke'. Perfume has played an important role in everyday life, from masking unpleasant smells and soothing the skin, to anointing the dead. It is used today to express a mood or personality.

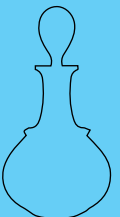
## YOU WILL NEED:

- a bottle
- water
- a funnel (can make one from paper)
- something to mash with
- homemade labels and a pen/ pencil
- citrus fruit such as chopped lemon or orange
- flowers and herbs.

### **We recommend:**

- Roses
- Lavender
- Jasmine
- Mint
- Rosemary

1. Push your chopped citrus into the bottle. Pour enough water to cover the fruit.
2. Mash the flowers and herbs to help release more oils, then add them through a funnel into the bottle.
3. Top up the rest of the bottle with water, close the lid and set aside to soak up the scents overnight.
4. Make a label for the bottle, listing ingredients and give your perfume a name.
5. Open the lid and test the scent.
6. Try different combinations to find your favourite scent.



# CRYPTIC EGG HUNT

The Museum of Zoology team has an affinity towards eggs, from Darwin's egg to camouflaged butterfly eggs, mouth-brooding cichlid fish to echidna eggs. Our love of eggs is especially strong around this time of year.

Spring offers the chance to see new generations hatching from a variety of eggs and in all sorts of nests.

This year we are bringing the eggs to you with a very sneaky twist.

# HIDDEN EGGS

Many species of birds lay camouflaged eggs that blend into their environments. This helps keep them safe from predators looking for a meal. However, other species use camouflage in different ways. Cuckoos are a brood parasite species, meaning that they lay their eggs in the nests of other birds, foregoing the responsibilities of parenthood and tricking their hosts into raising their offspring for them.

It is bad news for a bird to have its nest parasitised by a cuckoo. It uses up energy to feed a chick that is not its own, and the cuckoo chick pushes any other eggs out of the nest, so the host loses its own offspring as well. The host will be on the look out for cuckoo eggs, so to successfully fool other birds into accepting them, cuckoo eggs often look nearly identical to the eggs of their hosts.

Different populations of cuckoo produce different coloured eggs depending on which bird they are trying to trick. This egg mimicry can be amazingly precise. See if you can spot the cuckoo egg among the unsuspecting host eggs in our cryptic egg hunt!

Find more activities, stories from the animal kingdom, and learn about amazing adaptations on the Museum of Zoology blog: [museumofzoologyblog.com](http://museumofzoologyblog.com)

Birds also design and build their nests to keep their eggs safe. Find out more with expert Dr Jenny York, and learn to make your own nest, with our online craft-together event 'Feather Your Nest' on Monday 29 March: [eventbrite.co.uk/e/132051978021](http://eventbrite.co.uk/e/132051978021)

# HOW TO PLAY:

There is a cuckoo egg in each of the nests. Can you spot the egg that does not belong?

Find the answers at the bottom of the page.



©Nick Davies



©Nick Davies



©Rose Thorogood



©Claire Spottiswoode

## FULL CRYPTIC EGG HUNT:

[museumofzoologyblog.com/2020/04/10/cryptic-egg-hunt](http://museumofzoologyblog.com/2020/04/10/cryptic-egg-hunt)

## AFRICAN CUCKOO RESEARCH GROUP:

[www.africancuckoos.com](http://www.africancuckoos.com)

## THE BIRD THAT OUTSMARTS THE CUCKOO:

[museumofzoologyblog.com/2020/07/30/how-a-weaverbird-outsmarts-a-cuckoo](http://museumofzoologyblog.com/2020/07/30/how-a-weaverbird-outsmarts-a-cuckoo)

## FINCHES CAN BE PARASITES TOO:

[museumofzoologyblog.com/2020/08/13/parasitic-finches](http://museumofzoologyblog.com/2020/08/13/parasitic-finches)

**Answers:**  
**A - Bottom right** (common cuckoo, *Cuculus canorus*; reed warbler nest, *Acrocephalus scirpaceus*)  
**B - Bottom right** (common cuckoo, *Cuculus canorus*; reed warbler nest, *Acrocephalus scirpaceus*)  
**C - Top centre** (common cuckoo, *Cuculus canorus*; common reedstart nest, *Phoenicurus phoenicurus*)  
**D - Top left** (African cuckoo, *Cuculus gularis*; fork-tailed drongo nest, *Dicrurus adsimilis*)

# The Museum of Classical Archaeology



## GREEK HEROES AND HEROINES





Ancient gods came in all shapes and sizes. In this activity you will make your own, inspired by our collection! Here are two examples of what Greeks thought heroes were like.

## ODYSSEUS

In Greek mythology Odysseus travelled for ten years to get home. This was his punishment for arrogance.

**SPECIAL POWERS:** resourceful (has lots of ideas), problem solving

**PHYSICAL ATTRIBUTES:** traveller's hat

**CHARACTER TRAITS:** adventurous, loyal, arrogant

**APPEARANCE:** dishevelled, shaggy beard, muscular

## ARIADNE

This princess helped the hero Theseus defeat the Minotaur and escape from the labyrinth. Without her he would have been eaten.

**SPECIAL POWERS:** strategic thinking

**PHYSICAL ATTRIBUTES:** woollen cloak, crown

**CHARACTER TRAITS:** wise, helpful

**APPEARANCE:** young woman, long black-brown hair

## CREATE YOUR OWN HERO OR GOD

Find the insert that looks like the page, below. Choose what your hero/heroine is like by adding ideas to the four boxes. Draw something that symbolises those things next to them (for example a brain next to wisdom, or wings next to flying).

Give them a name. Male names in ancient Greece often end with -us, -os, or -es. Female names often end with 'a' or 'e'.

### SPECIAL POWER:

this is the thing that the person or god is really good at, their talent.

### PHYSICAL ATTRIBUTE:

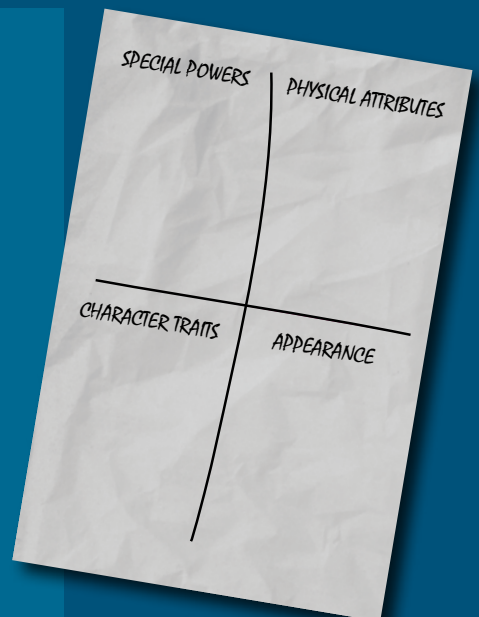
an accessory, a symbol or something they owned.

### CHARACTER TRAIT:

give your hero/heroine a virtue and a flaw. Remember that no one is perfect in Greek mythology.

### APPEARANCE:

how do they appear in Greek art?





Whipple  
Museum  
*of the History of Science*

SCIENCE THROUGH EXPERIMENTS

# LIGHT AND SHADOWS

Light bulbs in the collection at the  
Whipple Museum



## **YOU WILL NEED:**

**One or more light sources**  
(a torch, the sun, street lights, house lights)  
**A mirror**

## **WARNING!**

**The sun is a great light source, but it's very bright. Never look directly at the sun, keep your eyes on the shadows you're thinking about.**

You can use these to ask the following scientific questions:

**ARE SHADOWS ALWAYS ON THE OPPOSITE SIDE OF AN OBJECT FROM THE LIGHT SOURCE?**

Move the light source or the object and watch what happens to the shadow.

**CAN SHADOWS CHANGE SIZE AND SHAPE?**

Watch what happens when you're walking in the dark and move from one lamp post to another. Can you find some rules for the way the shadow changes size?

**DOES A MIRROR REFLECT LIGHT AT AN EQUAL ANGLE TO WHERE IT CAME FROM?**

Use a mirror to direct light from your light source to different places on the walls and ceiling. Can you work out how to "hit" a particular place with the light? People used to use this effect to make it look like there were ghosts in the room!



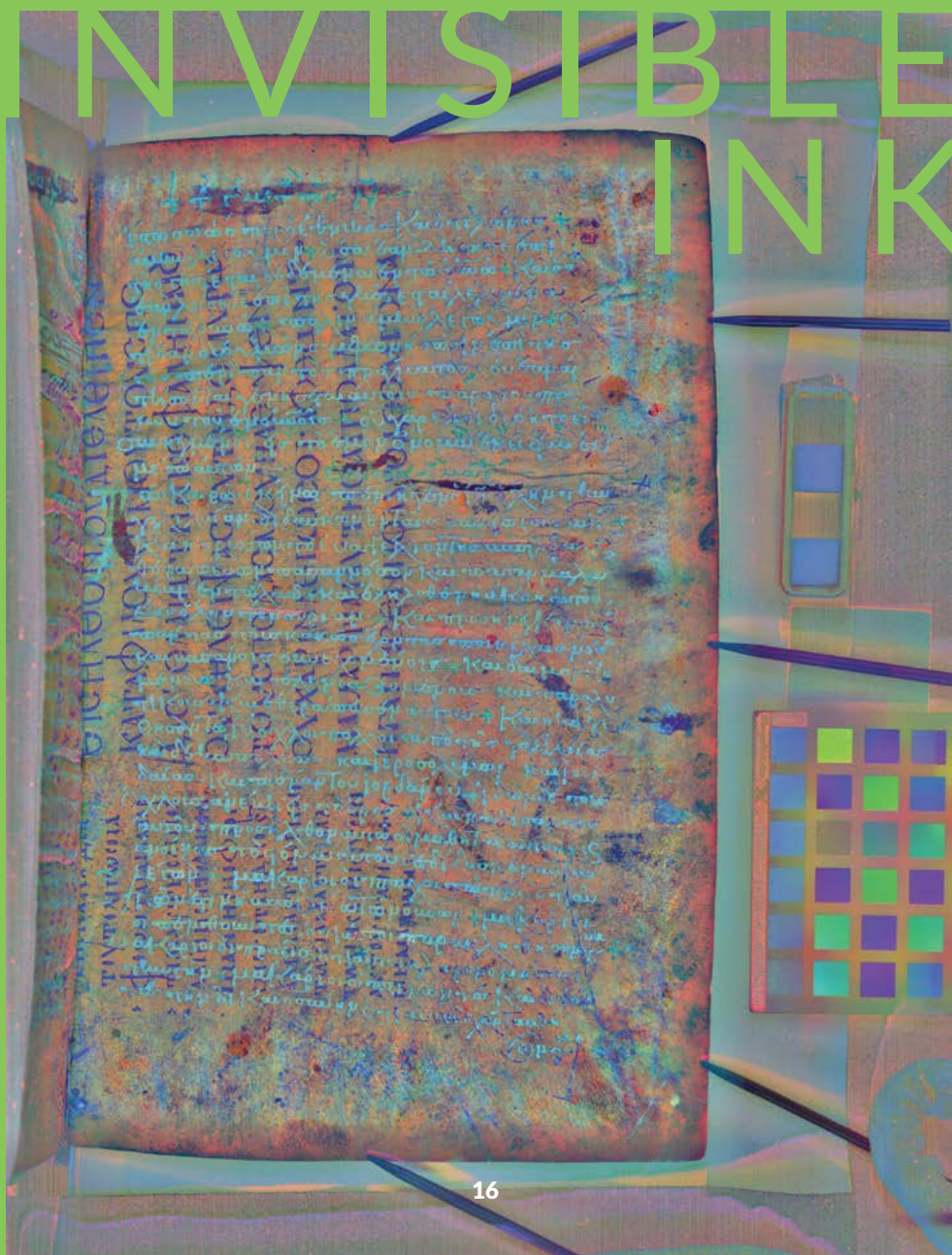


UNIVERSITY OF  
CAMBRIDGE

Cambridge University Libraries

WRITE A SECRET  
MESSAGE WITH

INVISIBLE  
INK












Cambridge University Library's exhibition, *Ghost Words: Reading the past*, takes a closer look at some of the lost words scraped off parchment and hidden beneath newer text, in objects known as palimpsests. These ghost words, which remained undiscovered for centuries, are being uncovered using a modern digital technique known as spectral imaging.

With this activity, you can create and reveal your own hidden message using this DIY invisible ink! What will your secret message say? And who will get to read it?

### WHAT YOU NEED:

-  Half a lemon
-  Water
-  Cotton bud or paint brush
-  Spoon
-  Bowl
-  Plain white paper
-  Lamp / torch / radiator

### METHOD:

1. Squeeze the lemon juice into the bowl with a few drops of water, and stir with the spoon.
2. Dip your cotton bud or paint brush into the lemon mixture and write your message onto the paper.
3. Wait for the lemon juice to dry so that it disappears completely.
4. When the paper is completely dry, heat it by holding it close to a torch or bulb, or over a warm radiator, to reveal your secret message!

### IMPORTANT!

**Supervision is required for this activity. Make sure your children do not hold the paper too close to the heat source, or for too long, as they might hurt themselves or burn the paper.**

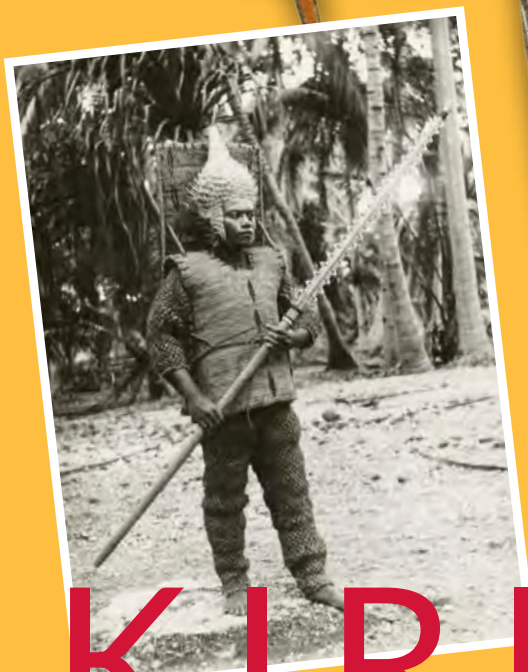


### BEHIND THE SCIENCE

How does this invisible ink work? When the lemon solution is heated, the juice oxidises and turns brown, revealing the hidden message!

**Discover more lost words...** by visiting our exhibition! Explore *Ghost Words: Reading the past* for free and from the comfort of your own home through the library's virtual exhibition platform. Head to [www.lib.cam.ac.uk/ghostwords](http://www.lib.cam.ac.uk/ghostwords) for details. #ULghostwords

maa  
museum of archaeology  
and anthropology



# KIRIBATI WARRIOR

## YOU WILL NEED:

- Scissors
- Glue
- Something to decorate your warrior: pens, pencils, crayons or paint. Or cut up coloured paper to glue onto the clothing. Use magazines, wrapping paper, food packets... whatever you have at home.
- Your Kiribati warrior cut-out page (see insert).

## STEPS:

- 1) Decorate the warrior's clothing and the warrior.
- 2) Cut out the warrior, clothing and weapons.
- 3) Glue the pieces together in this order:
  - Head guard behind warrior's head.
  - Coconut fibre body armour on top of warrior's body.
  - Cuirass on to warrior's chest (over armour).
  - Sword in warrior's hand.
  - Puffer fish helmet on warrior's head.

### **Photograph, opposite:**

One of the senior students at Rongorongo training college, Beru. Photographed by Reverend George Hubert Eastman, pre 1925, MAA P.4912.ACH1.

## BACKGROUND INFORMATION:

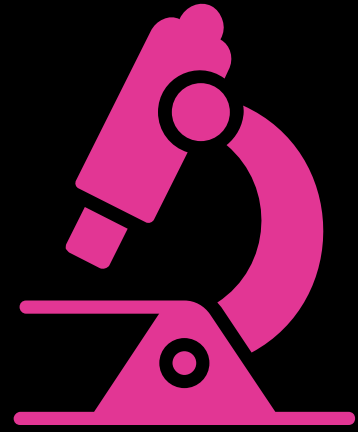
Kiribati is a nation of hundreds of small islands in the middle of the Pacific Ocean.

Over a hundred years ago, the people of Kiribati would settle arguments by having two warriors fight. The warriors wore armour made from the outside of coconuts. It took a long time and lots of people to make the armour. The warriors wore helmets made from dried out pufferfish and used swords edged with shark's teeth.

The warriors did not try to kill each other. If a warrior was killed accidentally, the other warrior gave many gifts to the dead warrior's family to apologise.

Today, the warrior is an important symbol of the islands and can be seen on lots of things in Kiribati, like T-shirts and other clothing.

If you visit the Museum of Archaeology and Anthropology, you will find a pufferfish helmet from Kiribati on display.

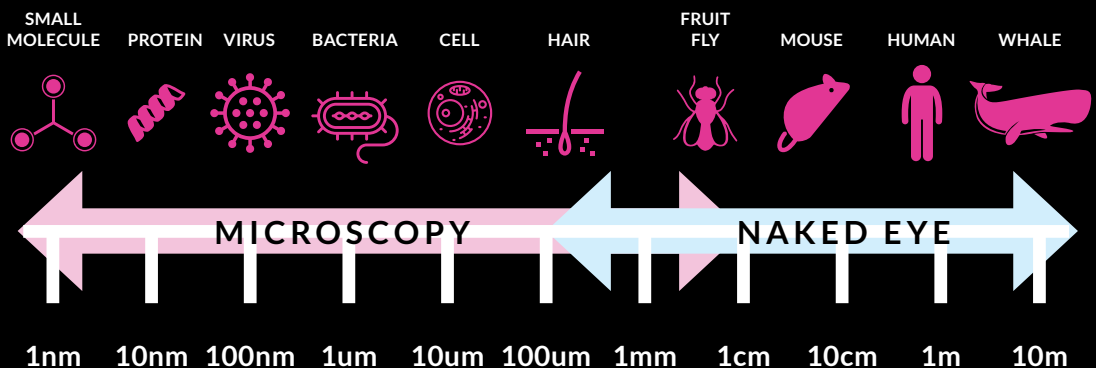


# ZOOM ON THE MICROSCOPE

A microscope is an instrument used to see objects that are too small to be seen by the naked eye.

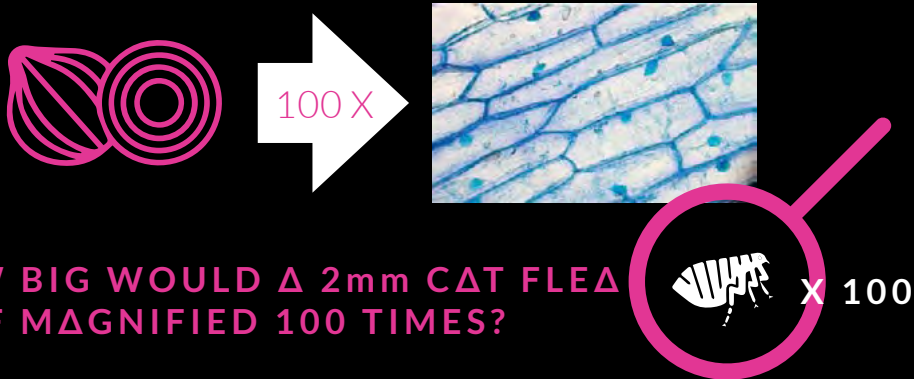
Our eyes cannot see anything smaller than the width of a hair!

## 1. CHECK OUT THE SCALE OF THINGS BELOW AND FIND OUT THE AVERAGE WIDTH OF A HAIR.



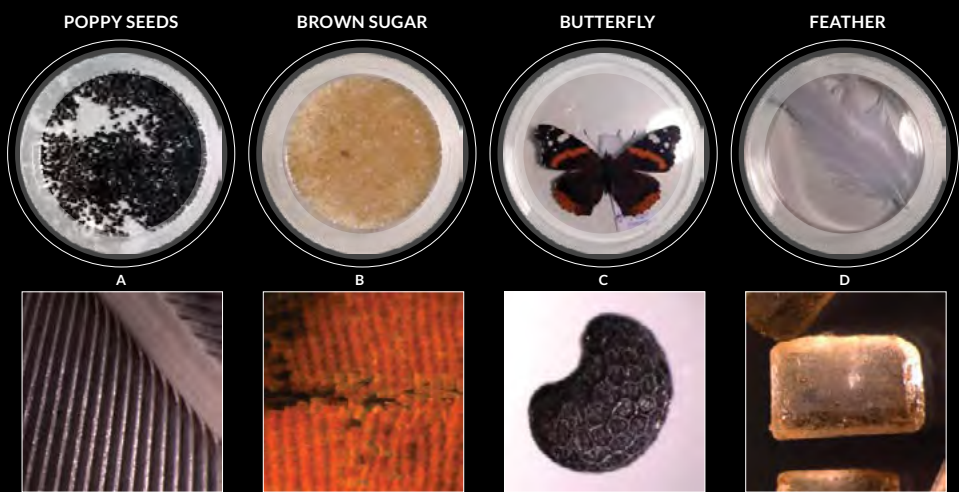


Magnification is when we make things appear bigger so that we can see them more clearly. We cannot see the cells making the layers found in an onion with our naked eyes because they are on average 0.25mm. But when enlarged 100 times, we can see the “brick wall” structure.



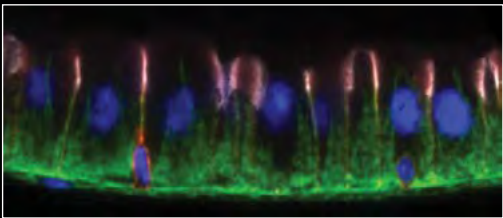
2. HOW BIG WOULD A 2mm CAT FLEA BE IF MAGNIFIED 100 TIMES?

3. CAN YOU GUESS WHAT EACH OF THESE ITEMS LOOKS LIKE USING A MICROSCOPE?



4. CAN YOU GUESS WHAT THIS IMAGE IS?

meter	m	10 <sup>0</sup>	1 m
centimeter	cm	10 <sup>-2</sup>	0.01 m
millimeter	mm	10 <sup>-3</sup>	0.001 m
micrometer	µm	10 <sup>-6</sup>	0.000001 m
nanometer	nm	10 <sup>-9</sup>	0.000000001 m



Answers: 1) A hair's width is about 50 micrometers; 2) 20 centimeters; 3) Poppy seed = C; Brown sugar = D; Butterfly wing = B; Feather = A; 4) Part of a fruit fly gut



# WHAT IS Δ LIVING THING?

TO COUNT AS A 'LIVING THING', IT MUST BE ABLE TO:

MOVE  
GROW  
REPRODUCE  
RESPOND <sub>Δ</sub>ND  
EAT

1. TICK THE PICTURES BELOW THAT SHOW Δ LIVING THING



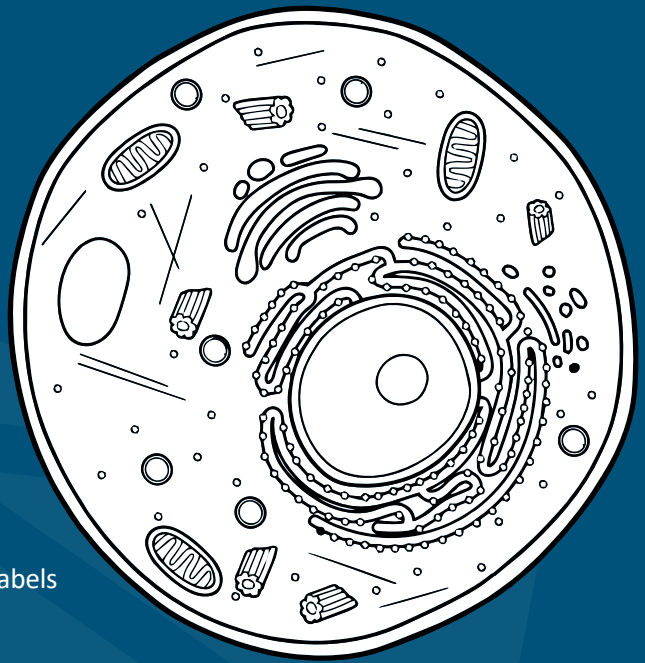
## SO WHAT ARE LIVING THINGS MADE OF?

All living things are made of tiny parts called cells.

This is an animal cell. We're made of cells just like this one!

Why not add some colour? You could even colour all of the different parts using different colours...

Which parts of the cell do you think these labels match with?



### CELL MEMBRANE

This helps control what can move in and out of the cell.

### MITOCHONDRIA

The power house (looks like a kidney bean!)

### NUCLEUS

Where all the cell's DNA is stored. The "brain" of the cell.

## 2. HOW MANY CELLS?

Every human starts out as just one single cell. That cell divides over and over and over until a fully grown human is made!

Guess roughly how many cells are in an adult human body...

- **3,700**  
(three thousand seven hundred)
- **37,000,000**  
(thirty seven million)
- **37,000,000,000,000**  
(thirty seven trillion)

## SO WHAT DO ALL THE CELLS DO?

Cells almost never live all by themselves. They work best in teams!

### CELLS

(e.g. neuron)



### BODY TISSUES

(e.g. epithelial)



### ORGANS

(e.g. lung)



### ORGAN SYSTEMS

(e.g. digestive system)

## 3) WHAT DO YOU THINK THE LARGEST ORGAN IN THE BODY IS?

## 4) WHAT MIGHT SCIENTISTS USE TO SEE CELLS BETTER?





Sedgwick Museum  
of Earth Sciences

# MAKE YOUR OWN GIANT SEA-SCORPION

On display in the Sedgwick Museum is a cast of an amazing 300-million-year-old fossil called *Megarachne servinei*.

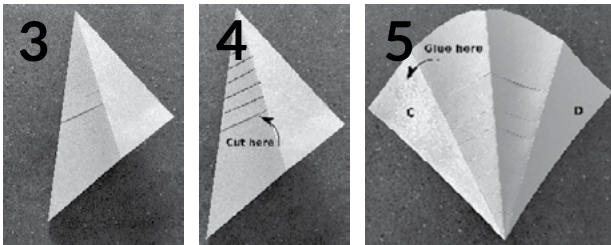
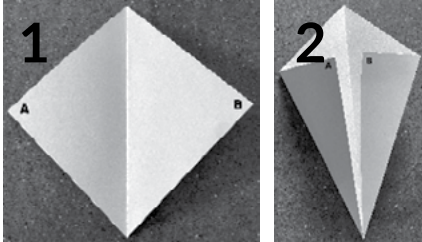
When it was first discovered in Argentina in 1980, scientists thought it was a giant spider. In 2005 a second fossil was found. The new fossil revealed more information and they realised the cast on display is actually an unusual creature called a eurypterid (yur-rip-ter-id) or sea-scorpion.

Follow the instructions opposite to make one.



## WHAT YOU NEED:

- A square of paper or thin card and some spare card for the legs.
- Scissors and glue.
- Coloured pens or pencils.

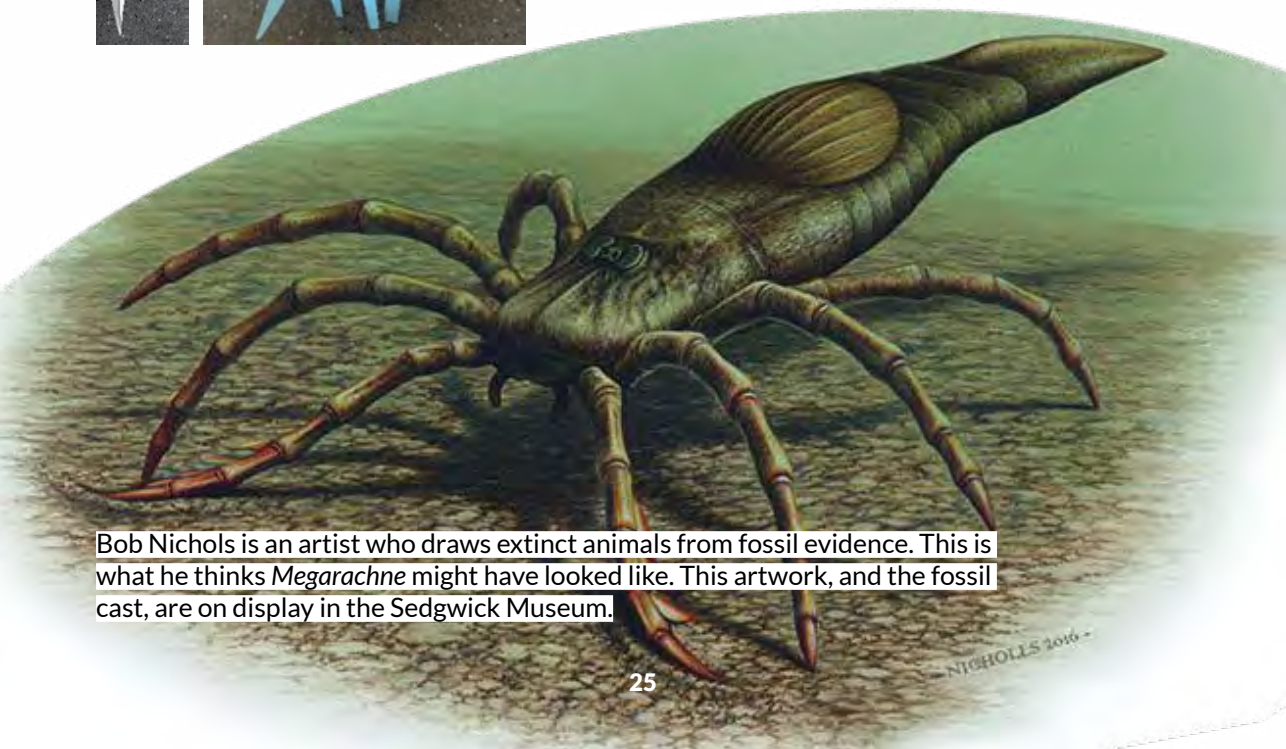


## OPTIONAL:

- Stick on eyes.
- Pipe cleaners/paper straws for the legs.

## METHOD:

- 1) Fold your square paper or card in half like this.
- 2) Fold 'A' and 'B' to the centre line.
- 3) Unfold and return it to a triangle shape, there should now be a fold across it.
- 4) Mark lines from the folded edge of the triangle to the fold in the middle and ask an adult to cut along the lines.
- 5) Unfold again and put some glue on 'B'. You can ask an adult to cut the head into a rounded shape.
- 6) Turn it over and glue 'A' to 'B' to create a cone. Decorate with colour pens adding some eyes and 8 legs.



Bob Nichols is an artist who draws extinct animals from fossil evidence. This is what he thinks *Megarachne* might have looked like. This artwork, and the fossil cast, are on display in the Sedgwick Museum.

CAMBRIDGE  
SCIENCE  
CENTRE

# HOW TALL IS MY TREE?



## MAKE A CLINOMETER TO FIND OUT...

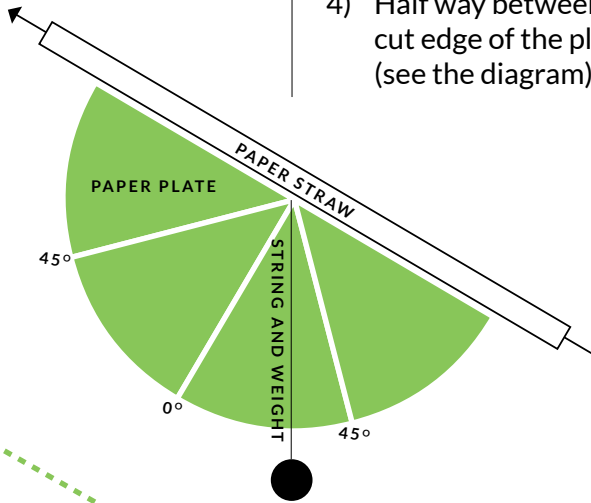
A clinometer is a device that measures the angle of elevation. You can use this to measure the height of tall things that you can't possibly reach the top of, like trees!

## WHAT YOU NEED:

- A paper plate
- A straw
- Sticky tape
- String
- Blu tack
- A helpful friend
- A tree to measure
- Measuring tape

## WHAT TO DO:

- 1) Cut the paper plate in half and tape the straw along the cut edge.
- 2) Exactly halfway along the plate edge tape a piece of string with a lump of blu tack on the end, so that the string dangles beyond the edge of the plate.
- 3) Hold the plate horizontally and mark the  $0^\circ$  point on the plate, where the string and weight fall straight down.
- 4) Half way between the  $0^\circ$  point and the cut edge of the plate mark the  $45^\circ$  point (see the diagram).



## NOW, GRAB A FRIEND AND FIND A TREE TO MEASURE...

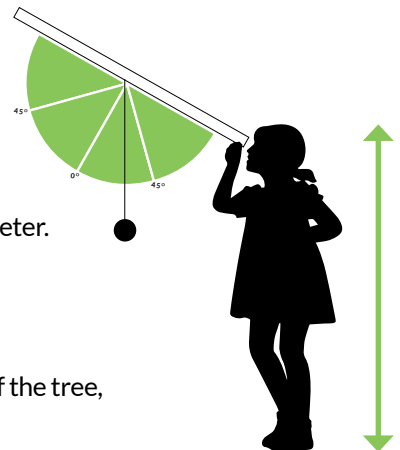
Look through the straw so that the top of the tree is visible.

Walk backwards and keep looking at the top of the tree through the straw.

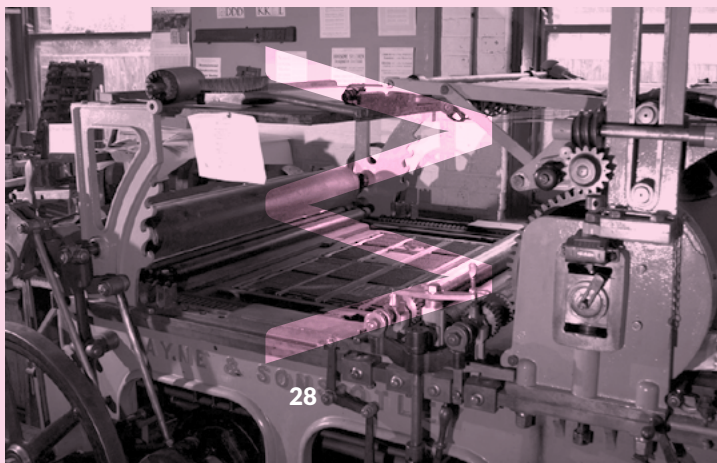
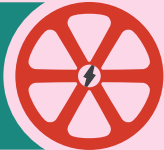
Ask your friend to tell you when the string and weight line up with the  $45^\circ$  point on your clinometer.

On the ground, measure the distance you are from the tree.

To get an accurate measurement of the height of the tree, add this distance to your height.









At the museum we have some old machines called printing presses which were used for printing books and newspapers. Each word had to be put together by hand using letters made of wood or metal. Ink was rubbed onto the letters and then they were pressed onto paper, using the printing press, to make a print.



Here's a page ready to print. Can you spot anything odd about it? The letters were specially designed. They could look...

funny old

FRIGHTENING

**EXCITING!**

Easy to Read

## LOOK AROUND YOU!

Words are everywhere. Look at products in your kitchen, books, websites and see how different shaped letters are used. If you are outside look for the letters used on street names, shop names and road signs.

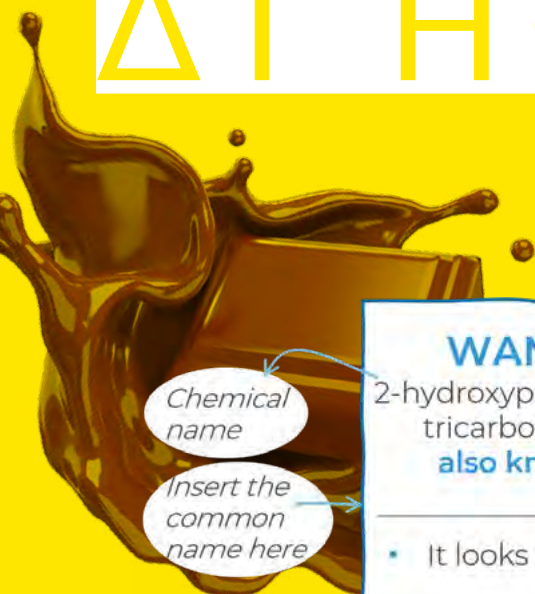
## BE A DESIGNER!

Design your own letters. Will your letters be friendly or frightening?

Make a sign for your bedroom door on the separate sheet near the back of the booklet using your own letters...



# MOLECULES AT HOME



Chemical  
name

Insert the  
common  
name here

Draw the  
molecule!

Write or draw  
where you  
can find this  
molecule in  
your home

## WANTED

2-hydroxypropane-1,2,3-  
tricarboxylic acid  
also known as

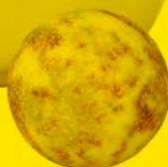


CITRACIO

- It looks like this:

- Last seen:

If you share your identikits on social media, don't forget to tag us @ccdc\_cambridge (or @ccdc.cambridge) so we will see the great work the CSD detectives have done!



## DETECTIVE NEEDED:

Molecules wanted! Chemical substances are hiding in plain sight in our houses: can you help us find them? To complete this task, you will need to fill in an identikit for them, by using our database of crystal structures, the Cambridge Structural Database (CSD). From the crystal structures you will learn about our “runaway” molecules and this will help you find where they might be hiding!

**Get your detective hat ready and let's find some molecules!**

## INSTRUCTIONS:

1. To start your search of the wanted molecules, ask an adult to scan a QR code with a phone. This will bring you to our database, the CSD, where you can find information on the chemical structure.
2. Now, to fill in the identikit, you need to find the common name of the substance, and then draw the molecule that you can see. In the database we use grey for carbon atoms, red for oxygens and white for hydrogens.
3. Where can you find the molecule in your home? Use the information from the CSD to help you fill in where the runaway molecule was last seen (write or draw it!). *Hint:* the images on the previous page provide some clues.
4. Repeat the search for each of the QR codes creating an identikit for each on a piece of paper.

**Once you find all the molecules, what do they have in common?**

**What differences do you observe?**

**Did you notice that there are only three different elements (C, H, O)?**

For more learning and more molecules, check out our **Crystal Adventures activities** at the Festival and don't miss out on other hands-on, fun activities!



SUCROS01

$\beta$ -D-Fructofuranosyl-(2-1)  
- $\alpha$ -D-glucopyranoside



JEMSAW

1,3-bis(octadecanoyloxy)  
propan-2-yl octadec 9-enoate



# WINDOWSILL GARDENING

Even if you don't have a garden you can still grow plenty of plants on your windowsill. Making your own pots and watching seeds germinate is really fun too.

**HAVE FUN WITH POTS**



**CAT GRASS**



**CRESS READY FOR HARVESTING**



**BASIL SEEDS SPROUTING**



**CARROT TOPS**



**GROWN FROM A DATE SEED!**



**CUT MICROHERBS AT BASE**



**VEGETABLE CONFETTI!**





## STEP 1 - MAKE SOME POTS

You don't need to go to buy any fancy pots for your windowsill garden. It is much better for the planet and more fun to reuse things that are about to be thrown away. So start raiding your recycling! Plastic tubs, yoghurt pots, tin cans, and drinks bottles (with the top cut off) can all make great little containers for growing. Use your art supplies to decorate however you want.

---

## STEP 2 - CHOOSE WHAT TO GROW

### **Cat grass**

If you have cats why not grow cat grass? Cats love to eat it and it keeps their digestive system healthy. Simply sow plenty of cat grass seeds in a tray of compost and water. It will germinate in a few days and you'll be amazed how much your cat will love it. Trim your cat grass as it gets long. Cats like the fresh young shoots best.

### **Cress & microherbs**

Cress seeds are a favourite to grow because they germinate so quickly. When we tried this activity at home we could spot our seeds germinating after less than 24 hours!

Cress is a type of microherb. Microherbs are plants that can be harvested and eaten before they are fully grown.

Loads of plants can be grown in this way including radish, coriander, spinach and broccoli.

To grow cress or other microherbs, sprinkle lots of seeds onto moist compost or wet kitchen roll. Whichever method you use make sure your seeds don't dry out.

### **Carrot tops**

Carrot tops are super simple to grow. You don't need soil, seeds or even pots, just the tops of carrots. Place your carrot tops in a saucer of water on a windowsill and wait until they start growing.

You will notice green shoots start appearing after a week or so. The green shoots can be cut and sprinkled on salads.

### **Plants from pips**

If you can't easily get any seeds from the shops why not experiment with growing seeds from the fruit in your house.

We tried this at home last year and grew pomegranate, chilli, and a date palm! Experiment and see what seeds you can grow. Some can be grown as houseplants.

---

## STEP 3 - HARVEST AND EAT

If you are growing edible plants make sure you remember to eat them! Carrot tops and microherbs can both be cut and sprinkled over your food. Think of them as vegetable confetti!

With microherbs look for the first set of 'true leaves' to know when they're ready to harvest

These aren't the first two leaves that pop up as the seeds germinate, they are the leaves that grow after these. Snip the stems just above the soil.

Microherbs and carrot tops are very good for you. They are packed with vitamins and minerals.

# FROM BACTERIA TO SEPSIS

## ALL YOU NEED TO KNOW...



Bacteria are tiny little organisms which live all around us. They are sometimes known as “germs or bugs” and most of the time are completely harmless – indeed some of these bugs in our tummy are good for us. If you look at the objects above you may be surprised to know that they are all covered in bugs. In the kitchen where we prepare food though we should be careful to keep it clean to prevent some of the nasty bugs getting on our food!

Sometimes if bacteria get into the wrong place they can make us ill. A cut on your skin can get infected with bacteria, a sore throat or sore ear may be caused by bacteria.

All bacteria have special areas on their surface called antigens. These are detected by special proteins in our body - known as antibodies - which usually kill the bacteria. Under a very powerful microscope these antigens can look like blobs on the surface of the bacteria.

Antibiotics are medicines which kill bacteria. However, some bacteria have become clever and are able to stop the antibiotics working. To help them stick to cells in the body some bacteria have hair-like structures on their surface called fimbriae.

Sepsis can occur when a local bacterial infection gets into the blood stream and spreads throughout the whole body. It can cause damage to other organs including your kidneys, heart, lungs and brain.

Prompt recognition and treatment of sepsis with antibiotics can prevent this and save lives.

To find out more about bacteria and sepsis watch the YouTube video “From bacteria to sepsis - all you need to know”. You will follow the journey of a bacteria and discover how a simple infection can progress to sepsis.

# BISCUIT BUGS

Make sure you check anyone eating the biscuits can eat all the ingredients and doesn't have any allergies to the ingredients. Get an adult to help you.

## Biscuits

If you would like to bake your own biscuits here is a standard biscuit recipe (but you can also use any shop bought biscuit if you just want to decorate them):

100g butter  
50g white caster sugar  
150g plain flour

Put the ingredients in a mixing bowl and rub together with the tips of your fingers. Then when the mixture looks even throughout and like crumbs, squeeze together to form the dough.

If you would like to add other ingredients such as raisins or chocolate chips do that now.

Grease a baking tray and put small balls of the dough on the tray for each biscuit and flatten them with a spoon.

Bake for 12-14 minutes, then remove when golden and leave to cool.

## To decorate

Icing to stick the sweets on.

Sweets or grapes to stick on as the antigens. You could use different coloured or different sized sweets for antibodies attacking the antigen!

Liquorice or fruit strings to make fimbriae.

Now to make them look like bugs!

Enjoy eating your creations.







UNIVERSITY OF  
CAMBRIDGE

Department of Engineering

# SPACE SETTLEMENT DESIGN PROJECT

What do you need for life? Air to breathe, water to drink and food to eat. A source of energy for light, heat and communications, exercise to keep you fit. If humans are to live on the Moon they have to develop ways to meet these needs from the resources of the Moon itself and by recycling materials, gases and liquids perfectly.

## **YOUR TASK IS TO DESIGN A MOONBASE FOR THE ARTEMIS MISSION, NASA'S RETURN TO THE MOON**

You should explain how your design would:

- Recycle CO<sub>2</sub> into breathable air
- Recycle dirty water and sewage into drinking water and plant food
- Feed the lunar settlers
- Generate electricity to run the MoonBase, for heating, lighting, transport and communications
- Contain gases and liquids so air and water are not lost to space
- Exercise the settlers so they stay healthy in a low gravity environment

For more information, visit  
[www.projectMoonbase.space](http://www.projectMoonbase.space)

**DEADLINE FOR ENTRIES:  
4PM ON THURSDAY 29TH JULY 2021**

## **INSPIRATION**

[www.iop.org/explore-physics/moon/how-could-we-live-on-the-moon](http://www.iop.org/explore-physics/moon/how-could-we-live-on-the-moon)

NASA has announced plans to go back to the Moon. These websites explain their plans. What would you do the same? What would you do differently?

[www.nasa.gov/specials/artemis/](http://www.nasa.gov/specials/artemis/)  
[www.nasa.gov/specials/apollo50th/back.html](http://www.nasa.gov/specials/apollo50th/back.html)

This YouTube video shows how to make *Blue Peter's* famous Tracy Island model. Could you adapt this method to make a model of your MoonBase? How would you keep the air in? [www.youtube.com/watch?v=6XzA0IY1yal](https://www.youtube.com/watch?v=6XzA0IY1yal)





Film: Wall-e UK rating = U  
BBFC information:  
<http://bit.ly/wall-e-bbfc>  
Wikipedia information:  
<https://en.wikipedia.org/wiki/WALL-E>

Does this film show perfect closed-loop recycling where all materials are reused?

For older makers (12+)  
Film: The Martian UK rating = 12  
BBFC Information  
<http://bit.ly/martian-bbfc>  
Wikipedia information  
[https://en.wikipedia.org/wiki/The\\_Martian\\_\(film\)](https://en.wikipedia.org/wiki/The_Martian_(film))

Soundtrack: The Race for Space by Public Service Broadcasting  
[https://en.wikipedia.org/wiki/The\\_Race\\_for\\_Space\\_\(album\)](https://en.wikipedia.org/wiki/The_Race_for_Space_(album))

## TECHNICAL STUFF

### How to enter

Email [outreach-officer@eng.cam.ac.uk](mailto:outreach-officer@eng.cam.ac.uk) to register for the competition and receive updates on the mission. We won't share your information with anyone else or use it for any other purpose and we will keep your email safe on a password-protected University server.

If you are under 13, ask your parent or guardian to register on your behalf.

More information and judging categories at [www.projectMoonbase.space](http://www.projectMoonbase.space)

# MEDICINE MAKER CHALLENGE

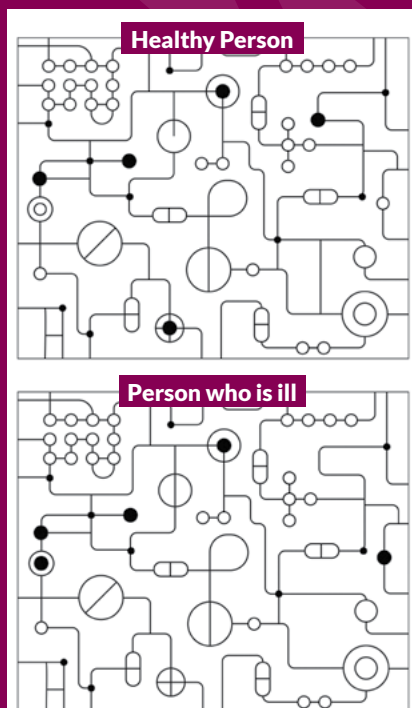
When making a new medicine, scientists start by studying the illness to find out what changes have occurred in the body. These are called 'target proteins'.

**HERE'S YOUR CHALLENGE:** Can you help find the target?

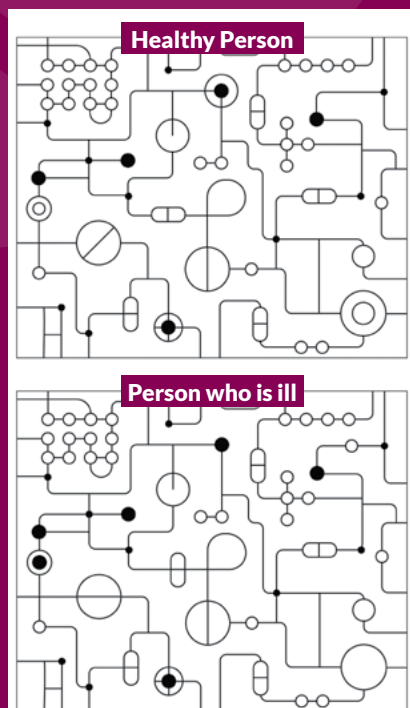
Compare the two diagrams below that show proteins in:

- A healthy person and an ill person.
- Spot the 6 differences in each to find the targets for this illness.
- Can you spot the difference that occurs in both people who are ill?

Pair 1



Pair 2



## DID YOU KNOW?

- Proteins control many things that happen in our bodies
- Scientists can compare proteins in a healthy person with someone who has an illness, in order to find new treatments
- Some proteins behave differently in an illness. These might be good targets for new medicine molecules
- There are over 20,000 proteins! Complex diagrams help us understand how they all work.

## MEDICINE MAKERS WORDSEARCH

All these words are important parts of making new medicines

M	A	B	O	H	E	C	L	A	C	I	N	I	L	C
B	E	O	C	P	R	O	X	E	K	T	K	D	O	T
S	T	D	H	E	E	V	I	D	E	N	C	E	P	A
S	E	Y	I	S	A	S	L	A	Y	H	T	W	S	R
T	A	L	O	C	K	I	L	L	E	U	S	I	K	G
D	S	T	U	D	I	E	S	W	L	M	C	L	P	E
O	R	G	A	N	O	N	I	C	A	T	I	L	V	T
M	O	P	E	M	O	L	E	C	U	L	E	N	C	L
T	E	A	M	W	O	R	K	K	T	O	N	E	H	K
L	A	B	O	R	A	T	O	R	Y	M	T	S	U	I
P	R	O	T	E	I	N	S	E	T	D	I	S	M	K
E	I	C	S	Q	C	Y	T	E	F	A	S	O	A	S
S	K	I	L	L	S	B	I	L	L	F	T	E	N	S
I	V	E	J	U	N	L	D	T	C	I	D	E	R	P
P	R	O	B	A	B	I	L	I	T	Y	D	V	A	B

Body   Illness   Molecule   Probability   Scientist   Clinical   Key  
Medicine   Protein   Safety   Evidence   Lock   Organ   Studies  
Teamwork   Human   Laboratory   Predict   Skills   Target

# SPECTROSCOPES



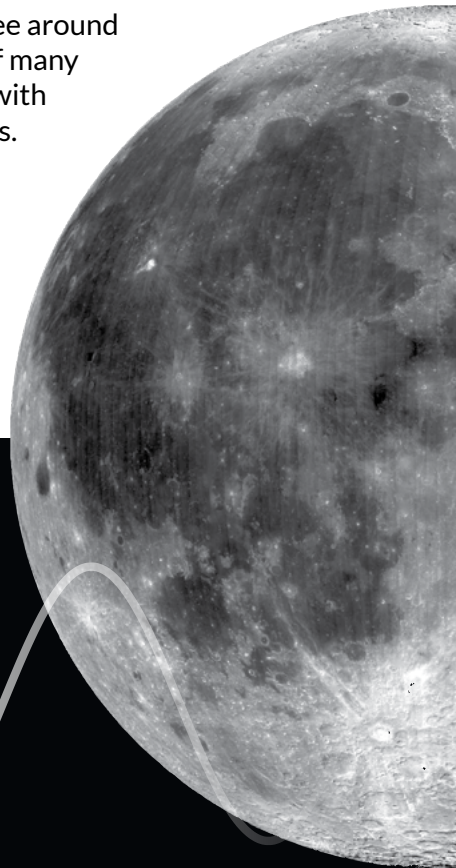
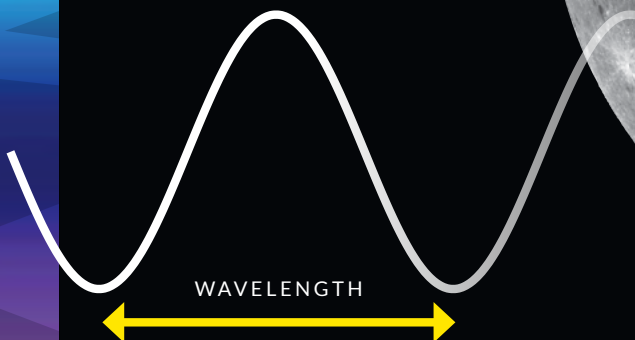
UNIVERSITY OF  
CAMBRIDGE

Cavendish Laboratory

Light spectrometers are used in a variety of scientific experiments, from geology to astronomy. Using only the print-out plan, a section of old CD, and a square of tinfoil, you can make your own fully functional light spectrometer and use it to investigate light sources around you.

## WHAT ARE LIGHT SPECTROSCOPES?

The light that we see around us is often made up of many different waves with different wavelengths. Light spectrometers split light up into individual wavelengths, which tells us about the object producing the light.





# SPECTRA

The patterns a spectroscope produces are called spectra, and this tells us which atoms make up the light source. You can see some examples here, the brightness of the lines depends on the temperature of the atoms. Astronomers use spectra to identify what atoms make up a star by identifying the wavelengths that produce the bright lines, or a planet's atmosphere, by seeing which wavelengths are absorbed.

## ANALYSING THE MOON

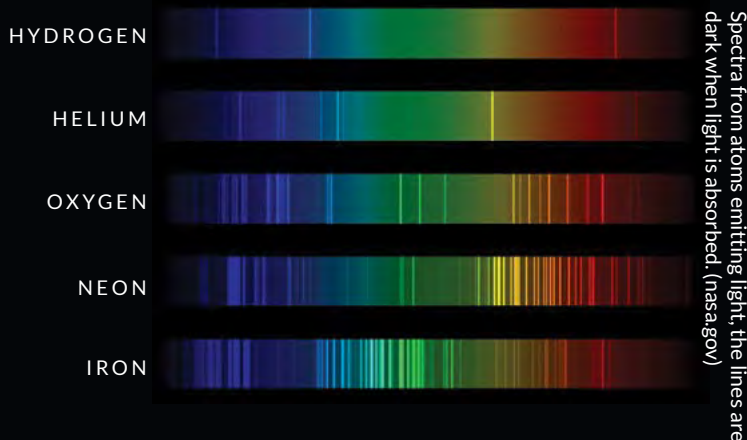
By analysing sunlight reflected off the surface of planets and moons, scientists can determine what the surface is made from. In 2009, the Chandrayaan 1 Lunar Orbiter (India's first mission to the Moon) used this process to identify frozen water at the Moon's poles! The information gathered by this orbiter will be essential for any moon base.

## MAKING THE SPECTROSCOPE

To make the spectroscope, you need:

- scissors
- an old CD
- 1cm square of tinfoil
- tape (ideally double-sided), and
- the plan in the back of this booklet, also available at: <http://outreach.phy.cam.ac.uk/projectmoonbase>.

Follow the instructions given on the plan and be sure not to look directly at any bright lights or put tape over the surface of the CD. Please contact the Festival if you have any issues ([cambridgefestival@admin.cam.ac.uk](mailto:cambridgefestival@admin.cam.ac.uk)).



# PUZZLES

## HIDDEN BRITISH ANIMALS

J V T B B M W K G O H E G D E H T  
M E Q A X B C A P U C I U C H G O  
V M X U R L D K E Y U E H J A K S  
G X F P Z E U S O T A O T S R W X  
V L C H E U U N S P W M S Z E J H  
P U T R D O S J R Q O E M W Z A R  
F Y I I M P R T C U U G A D L E L  
T J J R K S H S S T Y I U S G X F  
X K O H G D I E A A M K R D E Y O  
O D T O U E O B Z S F S A R I L D  
M I E G R J X L Q B G B O T E F X  
D F W E N L O I P P V O K V D L W  
D Z V I J J F A F H T Y G O X D R  
Y B V Y T S M Z N T I F V L J B F  
D T A C E L O P E S J N A E V E J  
O O G W T Y A R F B I R A B B I T  
A B E B J S E Q W E R H S D Z N P

Mouse Otter Deer Dolphin Seal Shrew Vole Rat  
Polecat Dormouse Bat Hedgehog Hare Weasel Stoat  
Squirrel Fox Badger Rabbit

# HOW MANY...

legs does an insect have?	
planets are there in the Solar System?	
sides on a pentagon?	
millimeters in a meter?	
colours in the rainbow?	
chambers are in a human heart?	
carats is pure gold?	
bones are in the human body?	
continents are there in the world?	
degrees in the three angles of a triangle?	

**ANSWERS:** 1: 6; 2: 8 (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune); 3: 5; 4: 1000; 5: 7; 6: 4 (right and left atria and right and left ventricles); 7: 24; 8: 206; 9: 7 (North America, South America, Europe, Asia, Africa, Antarctica and Australasia (Oceanía)); 10: 180

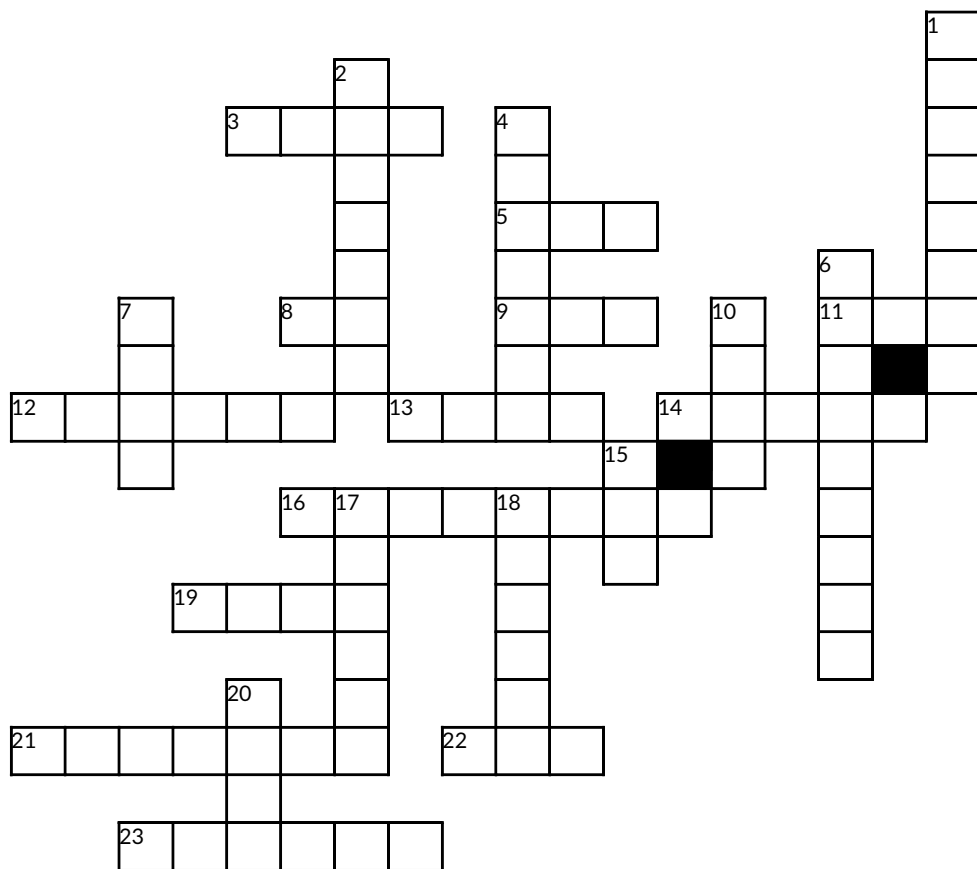
# MATCH THE SCIENTIST WITH THEIR WORK...

I proposed the theory of evolution by natural selection	Alfred Nobel
I proposed the theory of relativity	Louis Pasteur
An apple fell on my head and I had an idea!	Isaac Newton
I co-discovered radium	Jane Goodall
My work helped the discovery of the structure of DNA	Albert Einstein
I accidentally discovered penicillin	Alexander Fleming
I founded the science of genetics	Marie Curie
I was the father of modern microbiology	Gregor Mendel
I invented dynamite	Charles Darwin
I'm known for my work with chimpanzees	Rosalind Franklin

**ANSWERS:** 1: Charles Darwin; 2: Albert Einstein; 3: Isaac Newton; 4: Marie Curie; 5: Rosalind Franklin; 6: Alexander Fleming; 7: Gregor Mendel; 8: Louis Pasteur; 9: Alfred Nobel; 10: Jane Goodall

# PUZZLES

## SCIENCE CROSSWORD





## ACROSS

3. Rhinology studies which part of the body?
5. What is the SI unit of resistance?
8. What is 3.142?
9. Which type of tree has species including sessile, pedunculate and turkey?
11. Conjunctiva, iris and sclera are parts of which organ?
12. Who's comet appeared at the Battle of Hastings?
13. A porbeagle is what type of animal?
14. Hepatitis affects which part of the body?
16. Which geological period featured the dinosaurs?
19. Field, bank and water are what type of British mammal?
21. The human animal is known scientifically as Homo ----- ?
22. Which large flightless bird lives in Australia
23. Which scientist discovered vaccines?

## DOWN

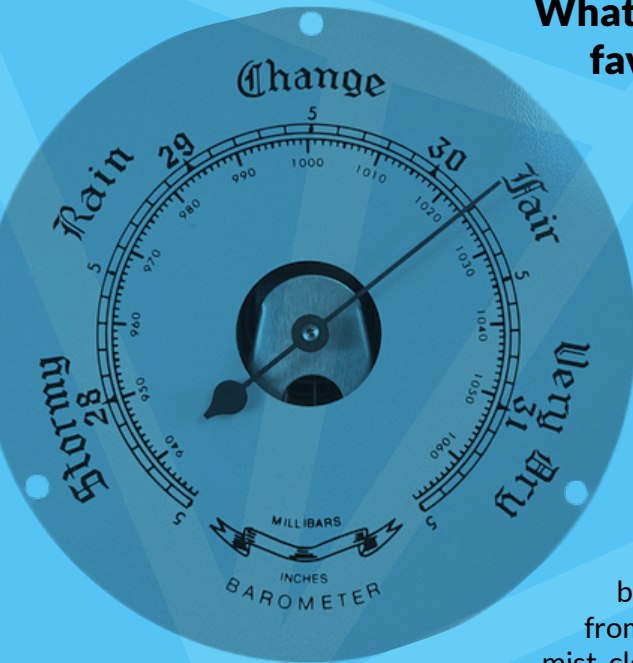
1. Which is the most abundant gas in the Earth's atmosphere
2. Which drug was found in the bark of willow trees?
4. The nucleus of an atom is made of neutrons and ----- ?
6. If a meteoroid manages to reach the Earth's surface, what is it known as?
7. Sodium chloride has which common name?
10. Which is the largest organ in the human body?
15. What's the name for a liquid lipid?
17. What is the scientific name for the womb?
18. Which chemical element has the symbol Na?
20. Which inert gas is used in lightbulbs?

## ANSWERS:

Across: 3 - Nose; 5 - Ohm; 8 - Pig; 9 - Oak; 11 - Eye; 12 - Halley; 13 - Fish; 14 - Liver; 16 - Jurassic; 19 - Vole; 21 - Sapient; 22 - Emu; 23 - Jenner  
 Down: 1 - Nitrogen; 2 - Aspirin; 4 - Protons; 6 - Meteorite; 7 - Salt; 10 - Skin; 15 - Oil; 17 - Uterus; 18 - Sodium; 20 - Neon

# FESTIVAL FAVES

## MAKE A BAROMETER



### What kind of weather is your favourite?

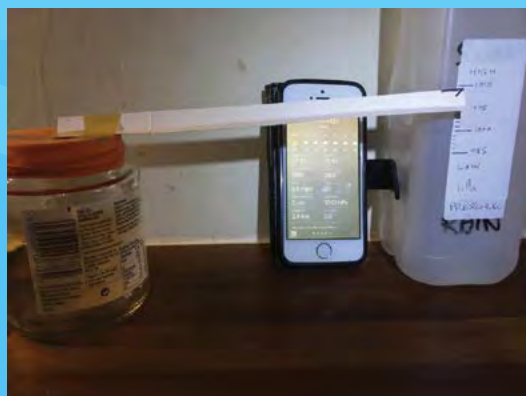
Weather comes as windy, cloudy, wet, cold, sunny and everything in between! But although you can't feel it, air is squeezing on us from all directions. It goes up beyond the clouds making our atmosphere, and all that air is on top of us, creating air pressure which changes all the time.

Air can absorb water, and how much water is in the air depends on temperature and air pressure - the higher the pressure, the more water can be absorbed. So when the air pressure goes from high to low, water in the air is seen as fog, mist, cloud or rain, and from low to high absorbs water gives clear cloudless sunny days. Barometers measure air pressure so are essential for forecasters.

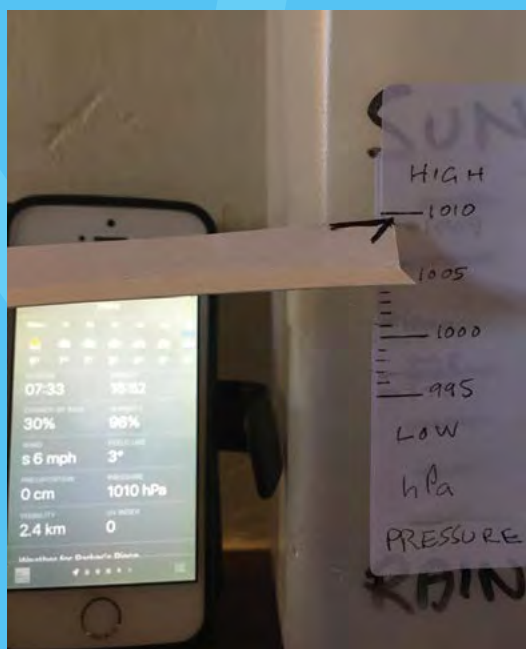
Lets make one so you can forecast the weather!

### YOU WILL NEED:

1. 2L milk carton
2. Jam jar
3. Sticky tape (Sellotape)
4. Balloon
5. Pair of scissors
6. Piece of card, say 30cm by 1cm
7. Felt tip marker



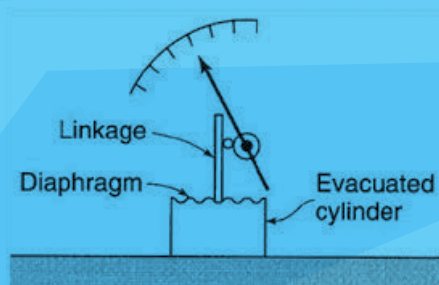
Take the lid off a jam jar and wash it out thoroughly. Cut the neck off a balloon, and stretch the balloon as tight as possible over the mouth of the jar. It has to be as tight as a drum, so stretch the balloon until all dimples disappear. Create a pointer out of the card by folding it lengthwise to stiffen it. Using sticky tape, attach the end of the pointer to the MIDDLE of the rubber balloon and the EDGE of the jar.



Test the barometer by putting it into a bowl of warm water - air pressure inside the jar will push the balloon out a little and the tip of the pointer will go down.

Finally put the jar on a cool place. Use a milk carton and stick a piece of paper to the bottle to make a scale. Mark today's pressure (you can find this on a weather app, newspaper or news broadcast) with a comment 'Sunny/Cloudy/Rain'. The next day repeat, and build the scale marking up day by day.

Super extra! Stick a piece of paper on a round bottle, and put it next to the pointer as before. This time mark the pointer position on the paper every day with a 'X' and twist the bottle clockwise 1 cm. Build a chart of how the air pressure and weather has changed over the week by joining up the 'X's.



Work out why the barometer pointer goes up with high atmospheric pressure. Why should the barometer be kept in a cool place?

# FESTIVAL FAVES

## MAKE A WATERCLOCK



### **How can we use water to make a clock?**

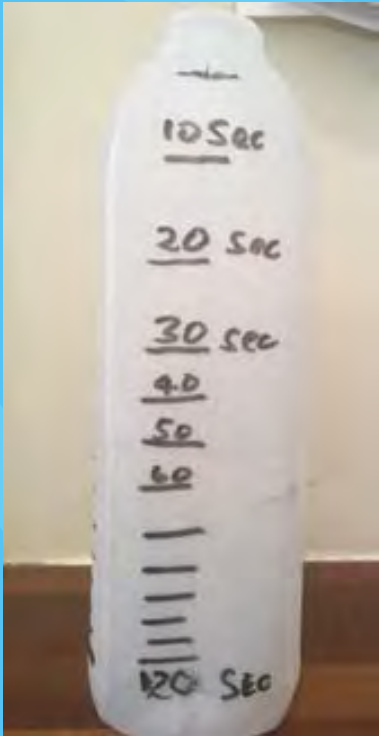
Water clocks have been used for thousands of years. Ancient Greeks and Romans filled large pots with water with a small hole at the bottom. As the water leaked out the level fell, and they could tell the time from when they first filled the pot.

You can make your own!

### YOU WILL NEED:

1. 2L milk container
2. Felt tip pen
3. Stopwatch (say the timer on a smart phone)
4. An object that can make a small hole in the container
5. A spare friend





Thoroughly clean and wash out the container.  
Remove the label.

Ask an adult to pierce the side at the bottom of the container – the hole needs to be about 1mm, enough for the water to dribble out slowly.

Put the container on the draining board in the kitchen. Make a mark about 2cm from the top. Get the stopwatch ready. Fill the container and start the stop watch when the level is at the mark.

Look at the stopwatch and call out when every 10 seconds goes past, and ask a friend to mark the container every 10 seconds until the container is empty.

If every mark is 10 seconds, and say there are 12 marks then how many seconds does it take for the level to drop from the top to the lowest mark?

You can use this water clock for measuring time!



## INVESTIGATIONS

- Are the marks evenly spaced? Try to think why this is not so.
- If the distance between marks is different what does it tell you about the amount of water that is dribbling out – is it the same for every 10 seconds?
- How could you make this idea measure time over a 12 hour period?

# WHAT DO YOU THINK?

We would love to see what you create from these activities.

Please share an image with us by emailing me at  
**cambridgefestival@admin.cam.ac.uk**

or post a picture on social media and include  
**#CamFest** so we can spot it!


Please use this QR code to let us know how much you have  
enjoyed taking part in our activities.





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