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EARTH & THE NATURAL WONDERS

SUPPORTS KEY STAGE 2

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How does the world spin? • **Powerful volcanos** • Inside a tropical rainforest
The hottest place on Earth • How deep is the ocean? • **Turn over for more...**

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This issue of

HOW IT WORKS

ILLUSTRATED

belongs to

Welcome to EARTH & THE NATURAL WONDERS

A complete guide to **our amazing planet** and its **mind-blowing** natural wonders!

From the makers of **How It Works**, the bestselling knowledge magazine

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Supports Key Stage 2 learning

Key Stage 2 learning is for kids aged 7 to 11 in Years 3 to 6 of primary school. All of the articles in **How It Works Illustrated** have been recommended by an educational consultant as suitable for Key Stage 2 students and beyond.

Brain games

Take a big quiz about our planet and its natural wonders!
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Look out for these...

Blue circles mean quiz time!

Send your answers to **contactus@howitworksdaily.co.uk** for a chance to win the next issue

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Amazing facts about Earth

Turn the page to get started

What was the most powerful eruption?

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Did you love it?

Place a tick where you see this symbol if you really enjoyed what you learned

Amazing facts about Earth

Our planet is full of natural wonders and incredible creatures. Get to know the unique and amazing place that we call home...

Earth in space

150 million kilometres

This is the distance between Earth and the Sun. That's the same distance as travelling around the world 4,000 times!

12,742 kilometres

This is Earth's diameter – how far it is across. It's the biggest rocky planet in the Solar System.

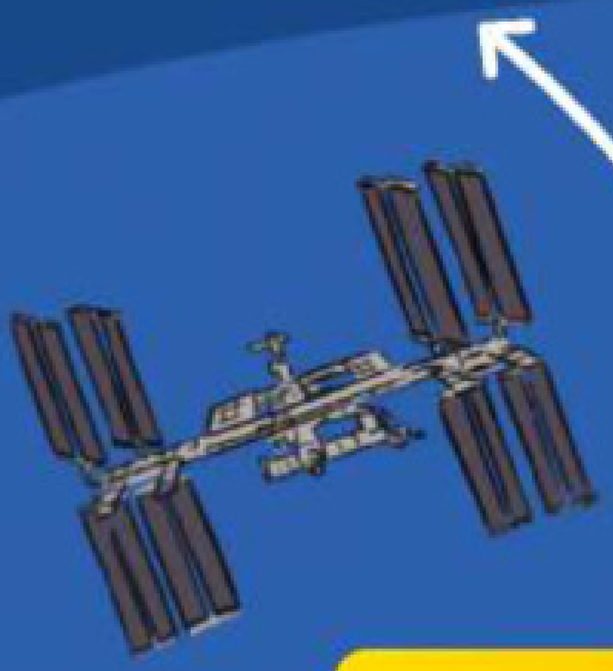
Third planet

Our planet is third from the Sun. It's in the Goldilocks Zone where temperatures are just right for life to exist.

30 kilometres per second

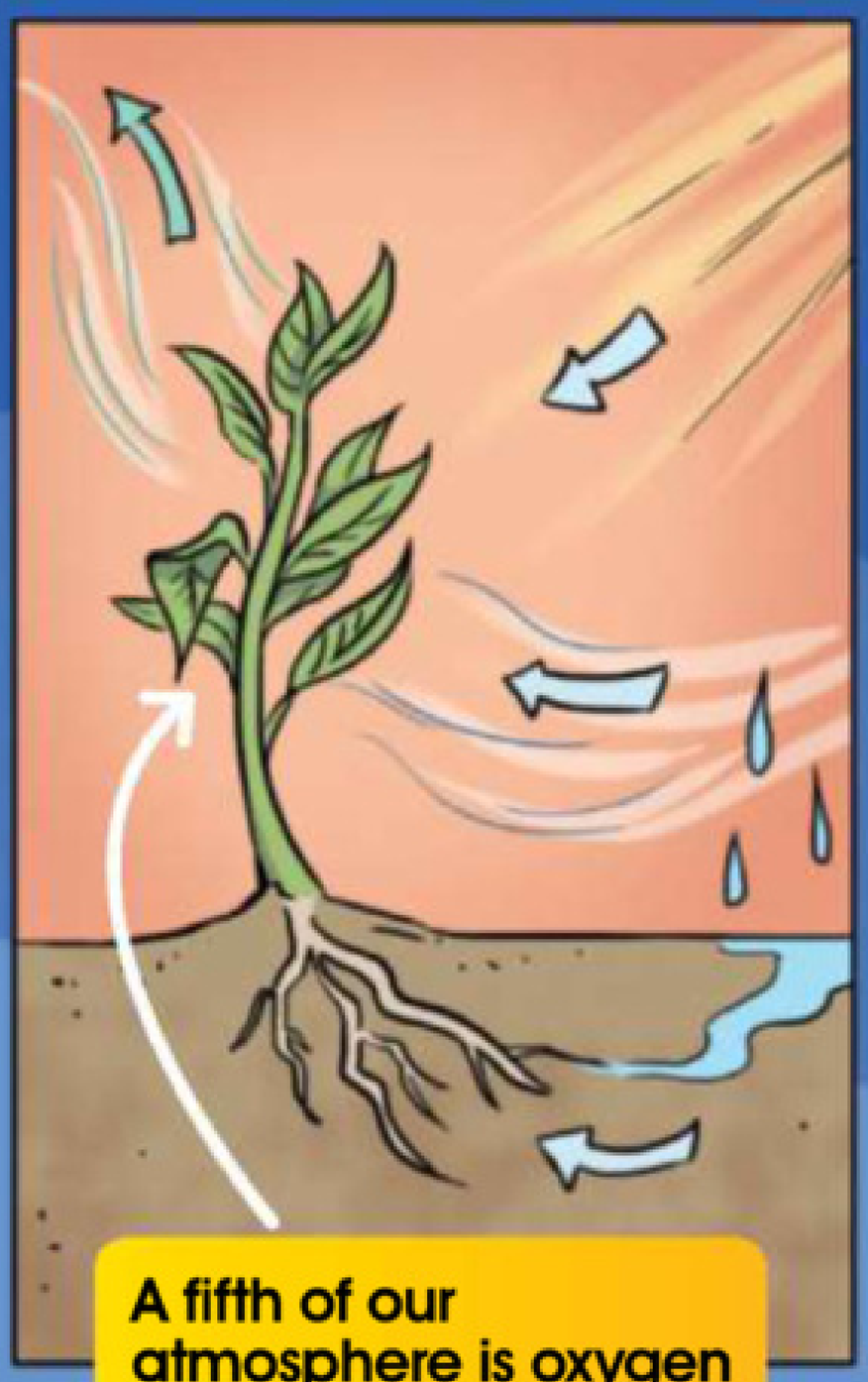
Earth whizzes around the Sun at this speed. We're moving through space over 100 times faster than an aeroplane flies.

Earth's atmosphere



100 kilometres
This is how far above the Earth's surface our atmosphere reaches. At this height some gases disappear into space.

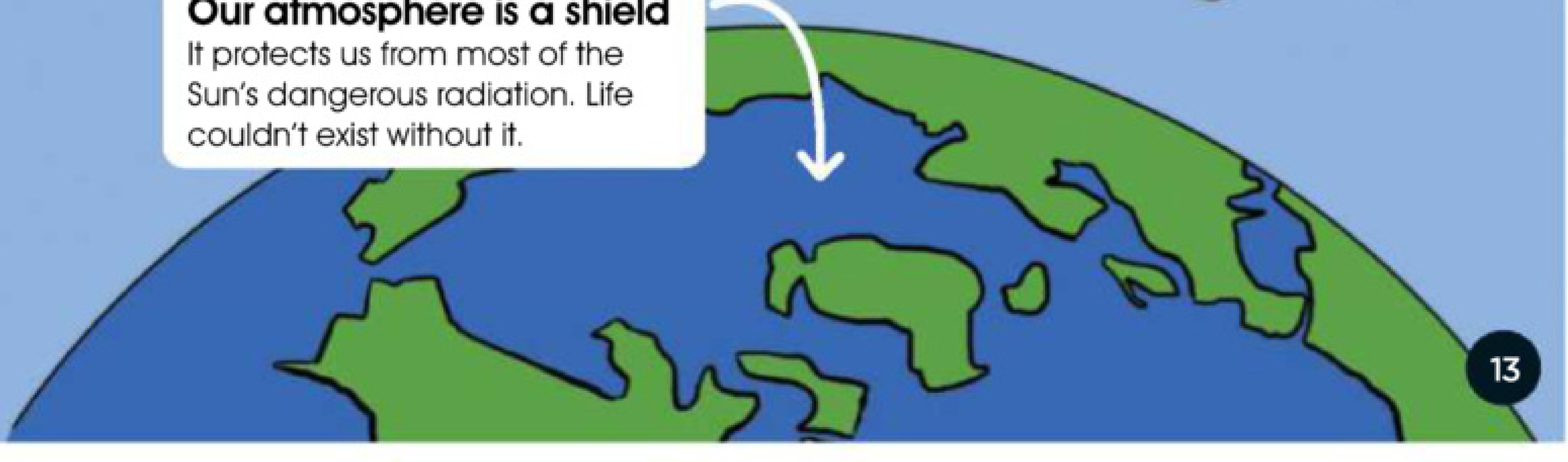
4 The atmosphere is made up of four layers. These have different pressures, elements and temperatures



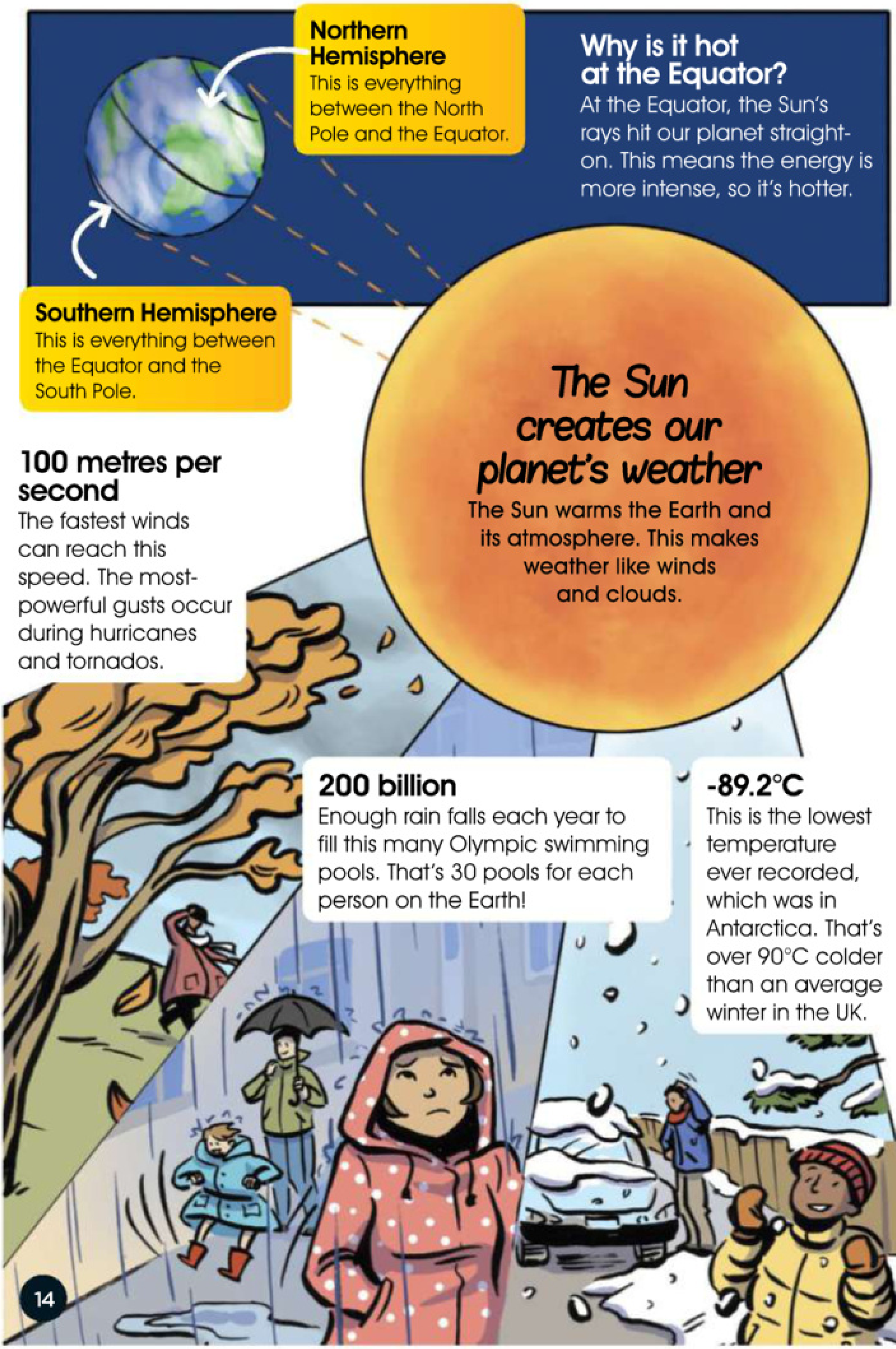
90%
That's how much of the atmosphere is below 16 kilometres. Earth's gravity holds the gas particles close to the surface.

A fifth of our atmosphere is oxygen
People need oxygen to breathe. Plants make this gas in a chemical process called photosynthesis.

Our atmosphere is a shield
It protects us from most of the Sun's dangerous radiation. Life couldn't exist without it.



Earth's weather



Life on Earth

8 million
Scientists think there are this many animal species on Earth. So far, they've only found about 1 million of them.

5,500
There are this many different species of mammal. This group includes the biggest animals on Earth.

10,000
This is how many different species of bird there are on the planet. They are the closest living relatives of dinosaurs.

9,500
This is the number of different reptile species in the world. They are found on every continent except Antarctica.

27,000
There are this many fish species in Earth's lakes, rivers and oceans. Scientists think there are still lots more to discover.

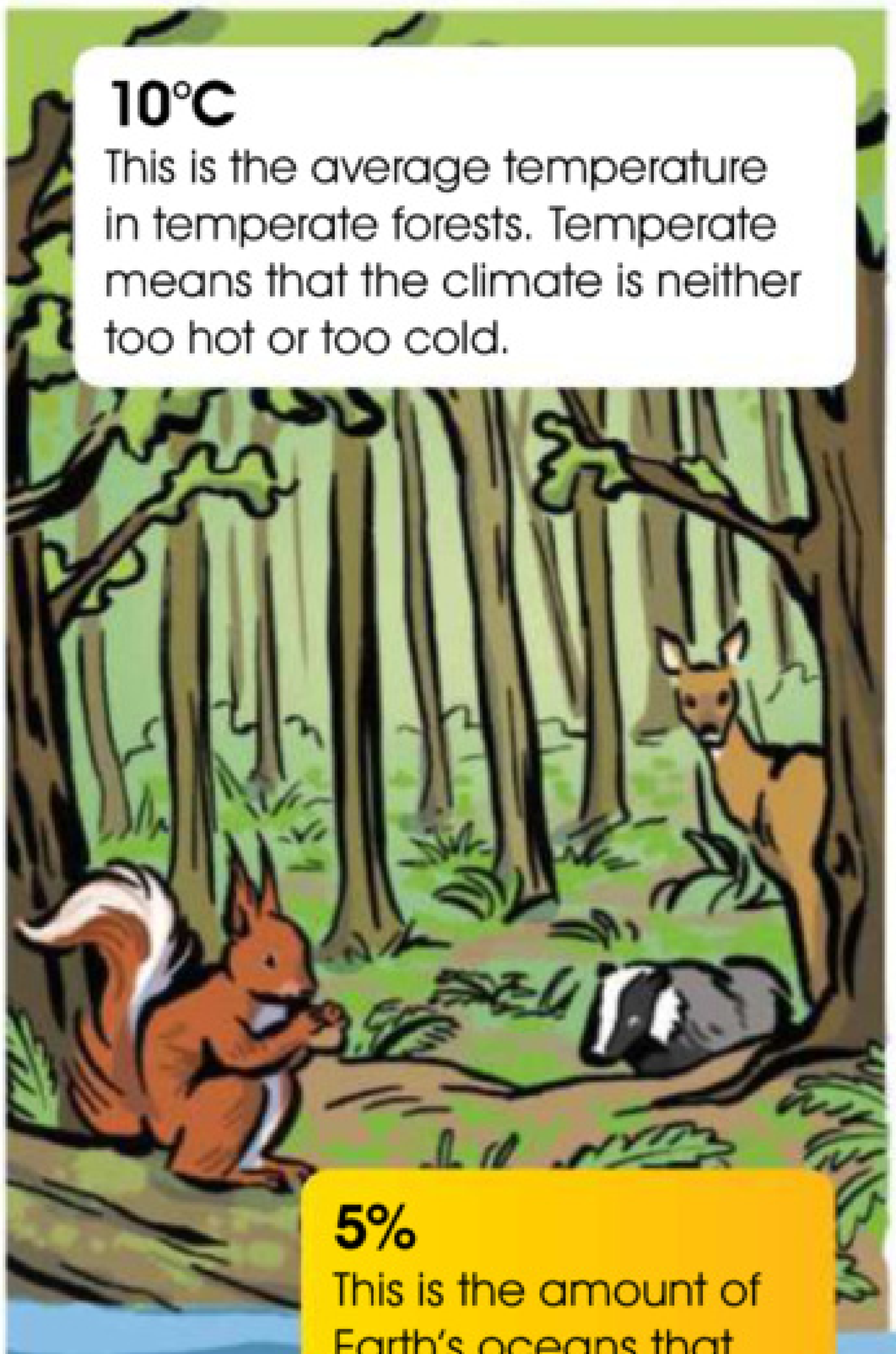
7 billion
This is the number of people on Earth today. That's more than double the global population of the 1960s!

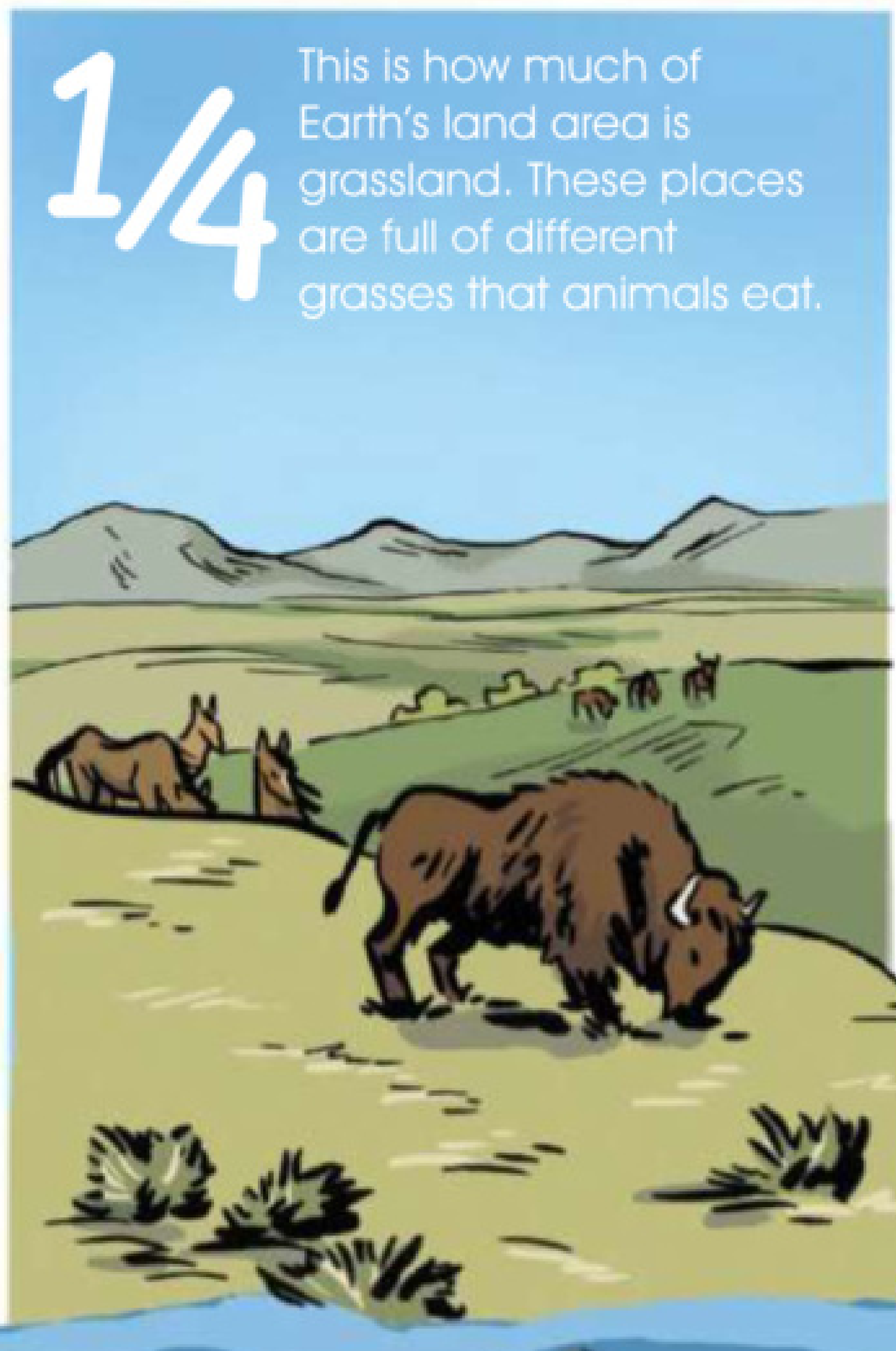
Life on Earth

69%
That's how much of Earth's fresh water is found at the polar regions. It's kept frozen in huge ice sheets.

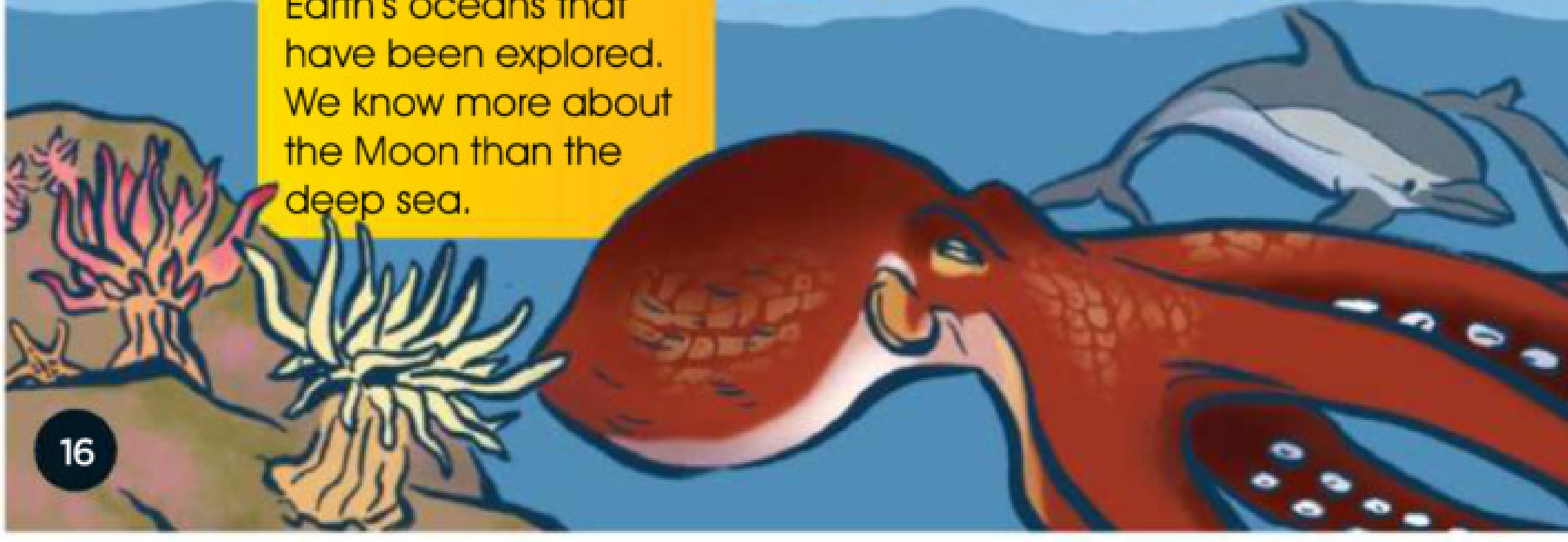
10°C
This is the average temperature in temperate forests. Temperate means that the climate is neither too hot or too cold.

1/4
This is how much of Earth's land area is grassland. These places are full of different grasses that animals eat.





5%
This is the amount of Earth's oceans that have been explored. We know more about the Moon than the deep sea.



Life on Earth

30 million
Scientists estimate that there could be this many different species of plants and animals living in rainforests.

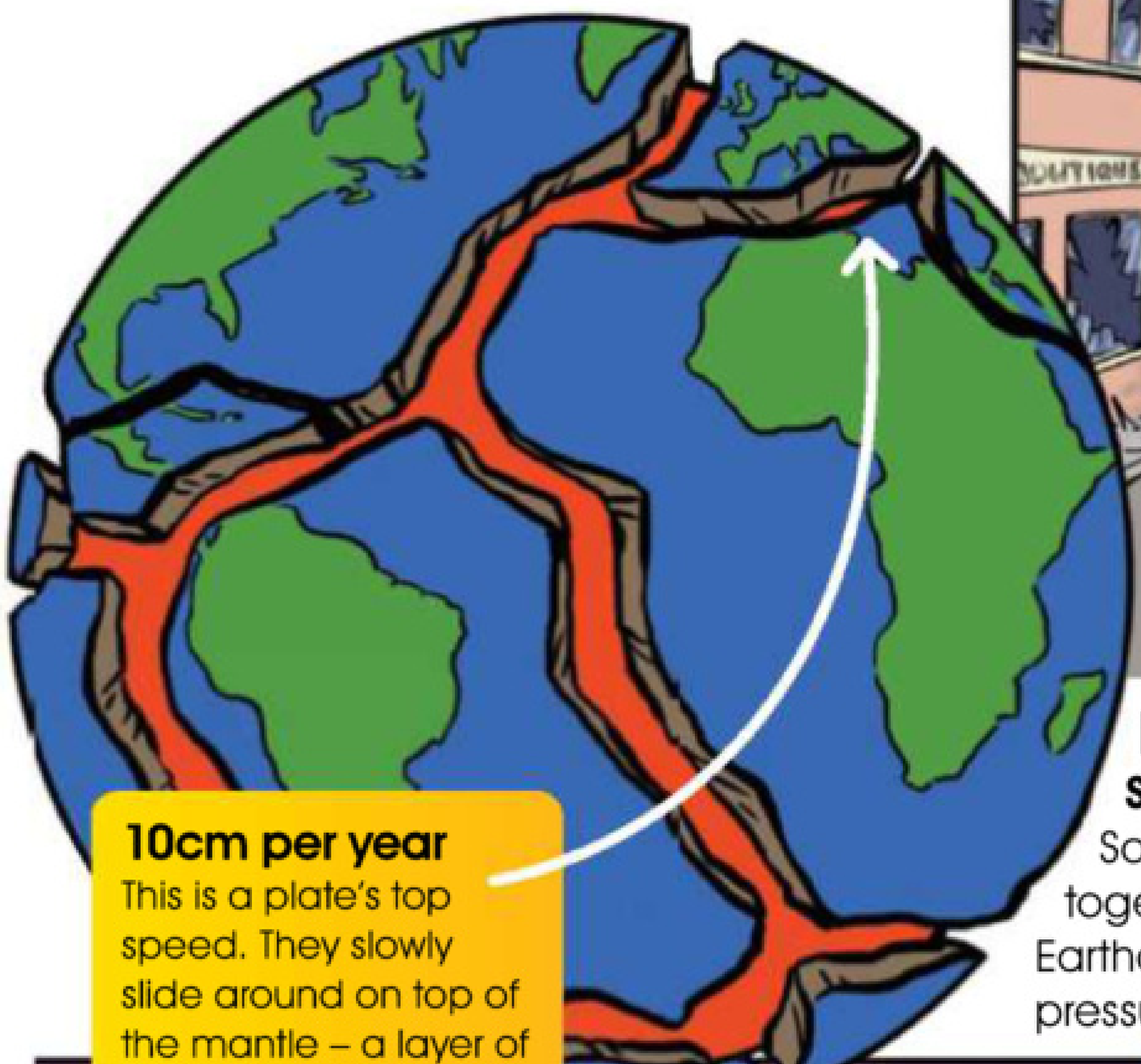
8,848 metres
This is the size of Everest, the highest mountain on Earth. That's over 90 times taller than Big Ben's tower!

400 years
That's how long parts of the Atacama Desert in Chile have gone without rain. It's the driest place on Earth.

Life came from the oceans
About 3.5 billion years ago, the first life forms on Earth evolved in the sea.

Volcanos and earthquakes

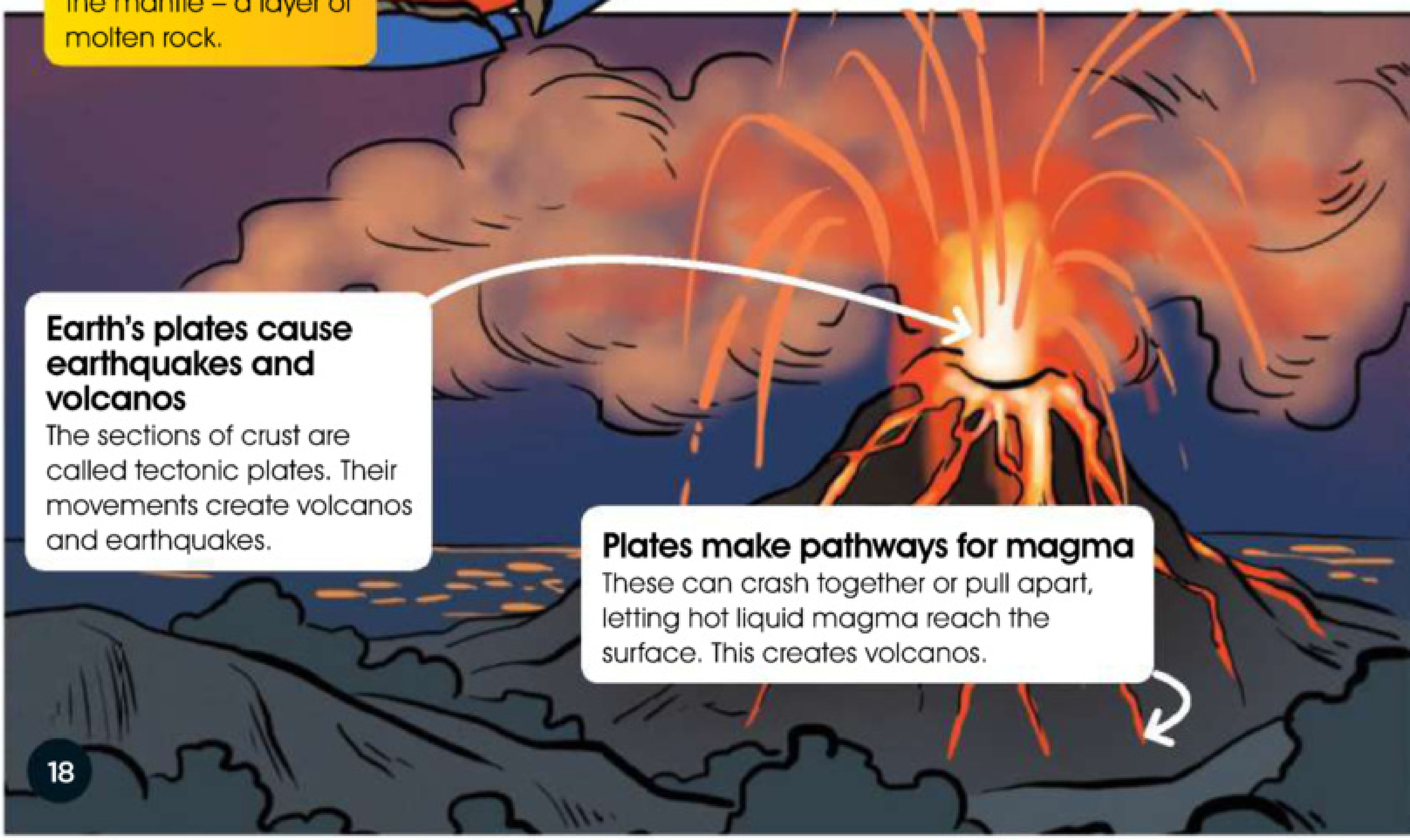
15 This is how many sections the Earth's crust is broken into. They gradually move towards or apart from one another.



10cm per year
This is a plate's top speed. They slowly slide around on top of the mantle – a layer of molten rock.

Earthquakes are a sudden release of energy

Sometimes plates get stuck together and pressure builds up. Earthquakes happen when the pressure is released.



Earth's plates cause earthquakes and volcanos
The sections of crust are called tectonic plates. Their movements create volcanos and earthquakes.

Plates make pathways for magma
These can crash together or pull apart, letting hot liquid magma reach the surface. This creates volcanos.

Earth's layers

1% *This is how much of Earth's volume is made up of the crust. It's the thinnest layer of the planet*

7,000 kilometres
This is the diameter of the outer core, which contains the inner core. That's twice the size of the Moon!

20mm per year
That's the average speed of material in the mantle. It gradually rises and sinks depending on its temperature.

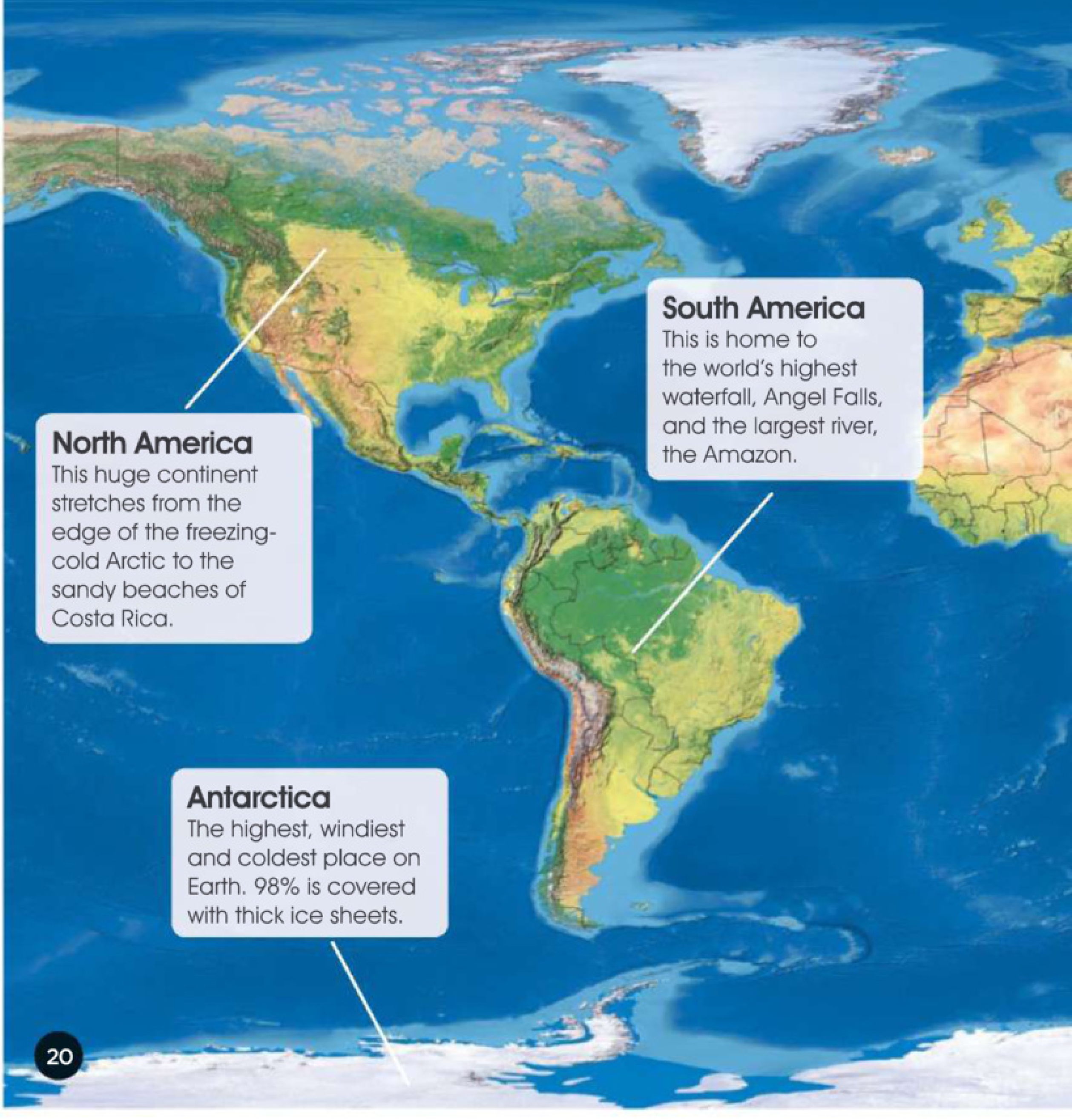
6,000°C
This is the temperature of the iron core. Although it's incredibly hot, the pressure is so high it can't melt!

The outer core creates Earth's magnetic field
Metals flowing in the outer core create magnetism. This protects Earth from dangerous space particles.

The inner core is growing
Scientists estimate that the solid inner core grows by about one millimetre every year.

What are **continents?**

Our Earth is divided into seven parts called continents. Some of these are surrounded by water, while others are joined together. Each one has **incredible sights** to see



North America
This huge continent stretches from the edge of the freezing-cold Arctic to the sandy beaches of Costa Rica.

South America
This is home to the world's highest waterfall, Angel Falls, and the largest river, the Amazon.

Antarctica
The highest, windiest and coldest place on Earth. 98% is covered with thick ice sheets.

Europe

This is joined to Asia. There have been lots of arguments about where Europe ends and Asia begins.

Asia

More than half of all the people in the world live in this continent. It has a population of over 4 billion… now that's a lot!

Pangaea

All the continents used to be joined together. This giant supercontinent was called Pangaea

Africa

The top half of Africa is mostly desert. This is called the Sahara and is the biggest hot desert on Earth.

Australasia / Oceania

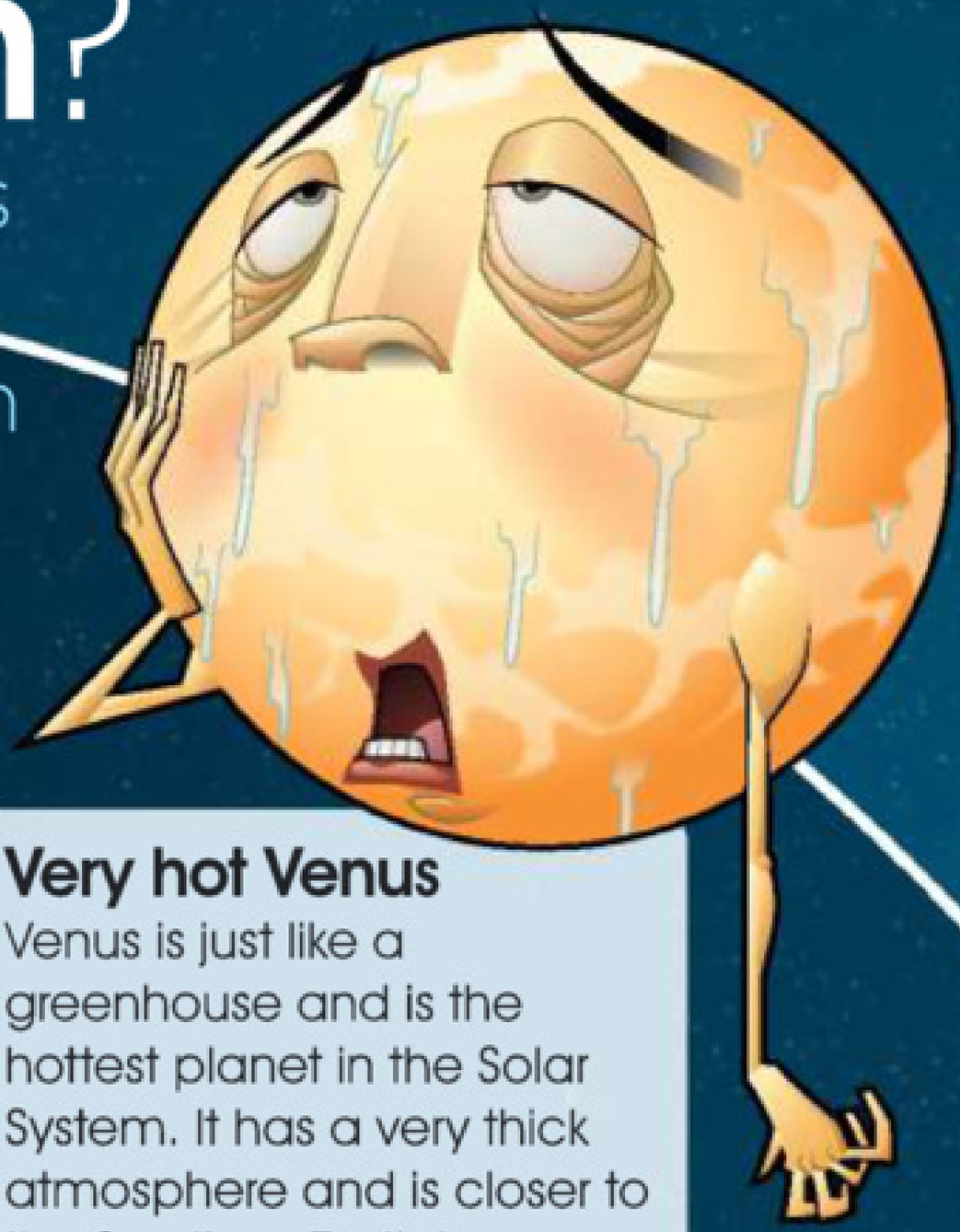
This is the smallest continent and is made up of around 25,000 islands. It is covered in rainforests and volcanos.

Why is there **life** on **Earth**?

Venus is too **hot** and Mars is too **cold**. Earth is **just right**, and that's part of the reason you're able to live here

Everyone has heard of Goldilocks and the three bears. If you remember, in the story a girl called Goldilocks goes into the three bears' house and tries three bowls of porridge. The first one is too hot, the second one is too cold, but the third one is just right. The third bowl that she tried had a perfect temperature. Our planet also has to be at a perfect temperature for you and all Earth's creatures to live comfortably, as well as for crops and other food to grow.

The reason why Earth is just right is because it is not too close or too far away from the Sun. It's in what some people call the Goldilocks Zone. Our planet also has a blanket called an atmosphere that is held tightly by a magnetic field. This traps lots of heat in to keep us warm and prevents harmful radiation from entering.



Very hot Venus
Venus is just like a greenhouse and is the hottest planet in the Solar System. It has a very thick atmosphere and is closer to the Sun than Earth is.

Sun-hugging Mercury
It might be the closest planet to the Sun, but Mercury is colder than Venus. It looks just like the Moon and it doesn't have an atmospheric blanket.

Chilly Mars

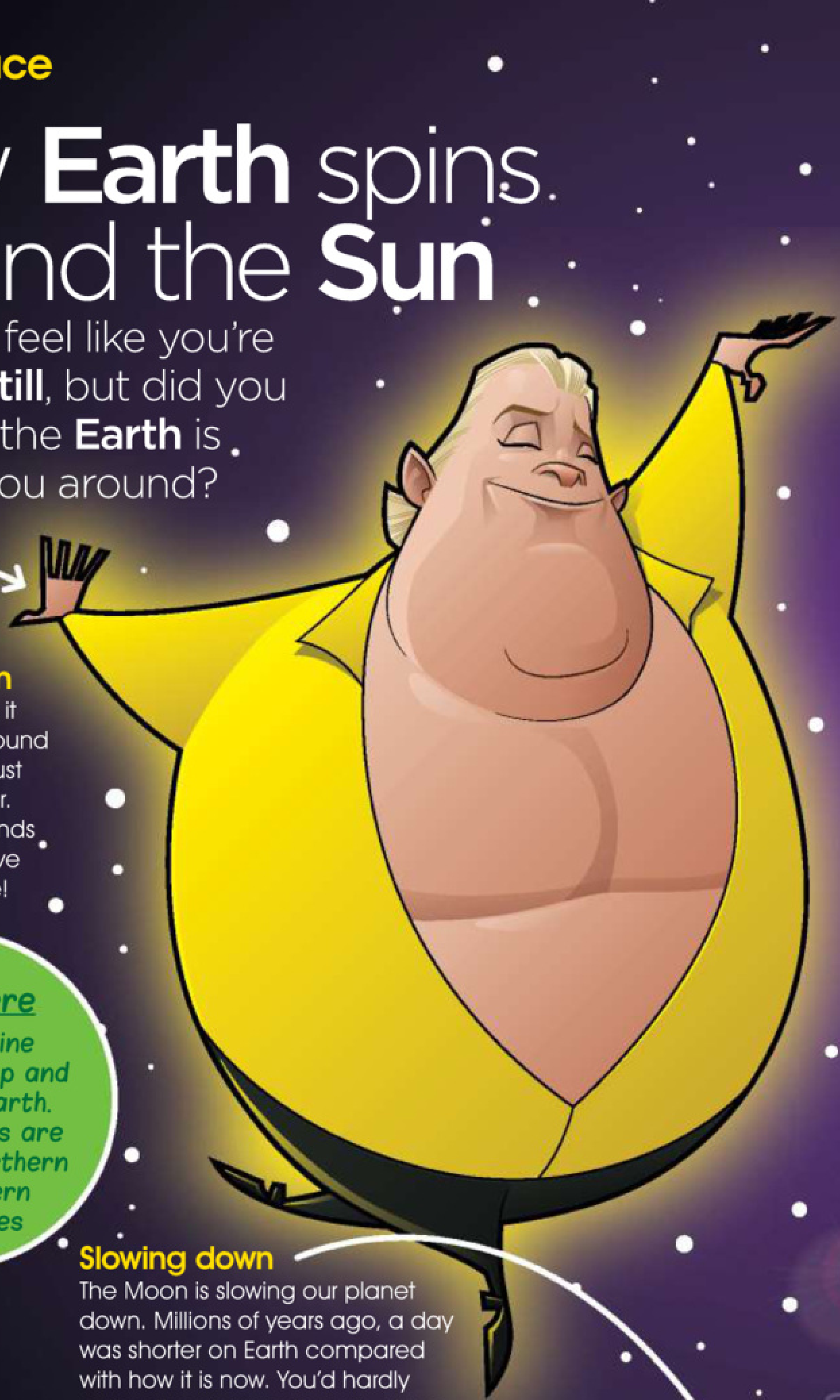
Mars is very cold because it is further from the Sun and does not have much of an atmosphere to get it warm. Like Venus, it wouldn't be a great place to live!

Perfect distance

Our planet is at the perfect distance from the Sun. It's not too hot or too cold. This means that our oceans don't boil away or freeze, and crops are able to grow.

How **Earth** spins around the **Sun**

You might feel like you're **standing still**, but did you know that the **Earth** is **spinning** you around?



Dance around the Sun

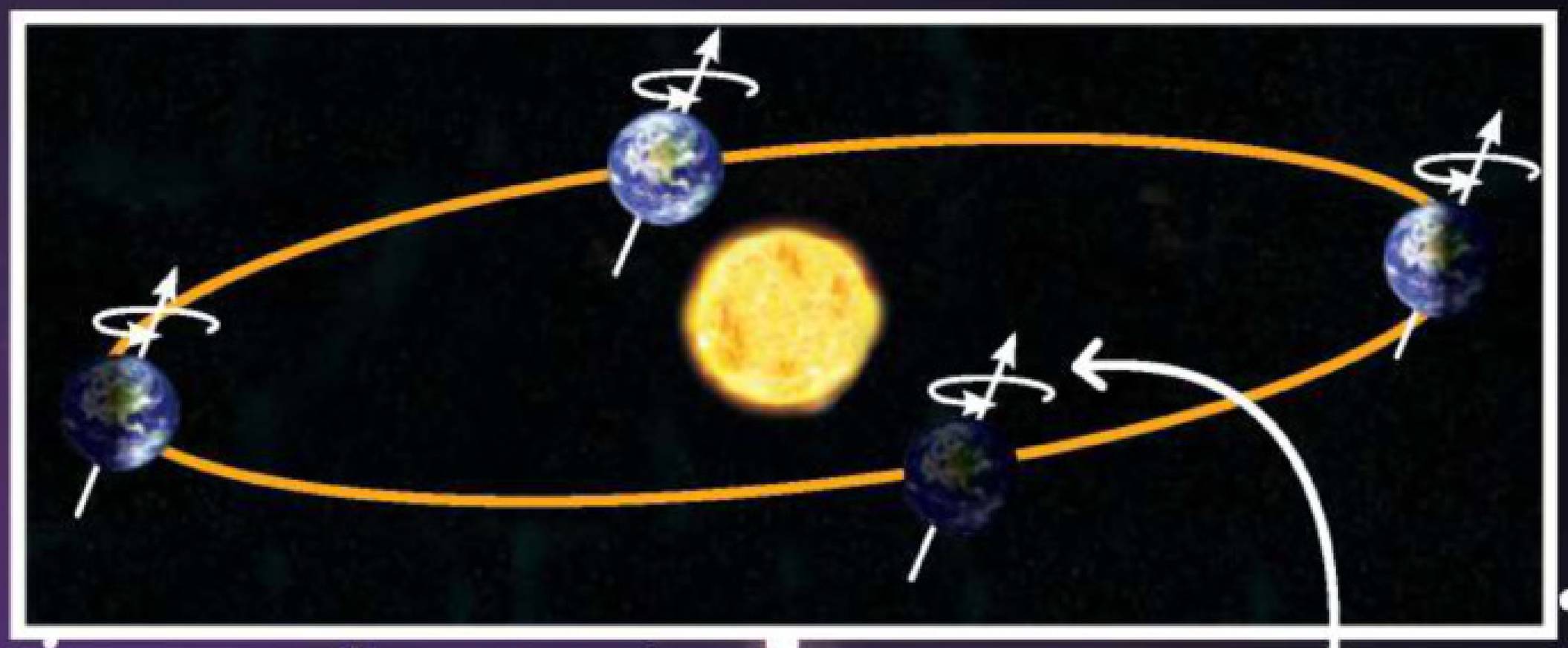
As our planet spins it also takes a trip around the Sun, spinning just like a ballet dancer. Count to two seconds and you would have moved a kilometre!

Hemisphere

Imagine a line dividing the top and bottom of Earth. The two halves are called the Northern and Southern Hemispheres

Slowing down

The Moon is slowing our planet down. Millions of years ago, a day was shorter on Earth compared with how it is now. You'd hardly notice the change though, since it's less than a second.



Backwards spin

On the Earth's surface, our planet appears to move from the west towards the east. But if you could get a bird's-eye view of Earth from a spaceship, you'd see that it spins the other way.

Speared by an axis

Earth rotates around an imaginary pole called an axis. It is tilted at around 23 degrees and makes our planet look like it has toppled over.

It takes our planet 24 hours to complete one turn, giving both sides their chance in the Sun

Why is there **day** and **night**?

Our planet **Earth** moves like a spinning top, turning in the **Sun's** bright light. It's because of this that we know when to **go to bed** and **when to wake up**

Our spinning planet
When your part of the world faces the Sun, it is daytime. When it's not facing the Sun, it is night.

Making day and night

If you get an orange and a torch and stand in a dark room, you can create day and night yourself. First make a mark near the middle of the orange with a felt-tip pen. Now shine the torch at the orange and spin it from left to right. You'll see the pen mark move from light into shadow. This is how night and day works on Earth.

24 hours

The time it takes for planet Earth to make one complete spin

The Moon and stars

We usually see the Moon and stars at night, but in fact they are always there. We often can't see them in the day, because the Sun's light is much brighter then.

Our brilliant Sun

The Sun is the brightest object in the sky and gives us daytime. It's also very hot and that's why you'll feel warmer during the day than at night.

Why do we **need** the **Sun**?

Without the Sun, none of us would be here. It keeps us **warm**, helps **plants** to grow and stops our planet from **floating away**!

It heats our planet to the right temperature

The planet would freeze if the Sun didn't exist. Luckily, we're the right distance away to stay at the ideal warmth.

It helps plants to grow

Plants turn light from the Sun into energy through a process called photosynthesis. Without sunlight, plants wouldn't live.

It keeps us steady in an orbit

The Earth rotates around the Sun because it has stronger gravity. If it weren't there, we'd just float off!

It gives us light to see

The Sun is really important because it helps us to see things. Apart from electric lights and candles, it's our only light source.

It keeps us healthy

The Sun helps our bodies produce vitamin D. This keeps our bones, skin and hair healthy.

We can turn it into power!

Solar panels take heat and light from the Sun and turn it into electricity. We can use this to power our homes and cars.

Why do we **need** the **Moon**?

Without the Moon, we wouldn't be able to **see** at **night**. It also helps to keep the **Earth steady** and stops it from **flooding**!

384,400km

The distance from Earth to the Moon. That is the same as going around the world four and a half times!

It creates the oceans' tides

The Moon pulls our ocean water towards it. If it disappeared, many countries would be flooded.

It stops planet Earth from wobbling!

The pull from the Moon's gravity helps to keep Earth's tilt stable. Without it we'd wobble around!

It gives us a launch pad to Mars

In the future, NASA scientists are planning to use the Moon as a stopping-off station on the way to Mars.

It helps us learn about space

By going to the Moon and bringing bits back, we are able to learn loads about how the rocky planets were created.

It lights the world at night

Light from the Sun reflects off the Moon, giving us light at night. This means we can still see things after the Sun sets.

It stops some things hitting us

The Moon's gravity attracts meteors and asteroids that fly through space all the time, taking some hits for us.

Why is it **cold** in **winter** and **hot** in **summer**?

Our **Earth** is **tilted**. It is because of this tilt that we have **seasons**. It's summer in the part that is closer to the Sun and winter in the part that is further away

Though we can't feel it on Earth, our planet is wonky. It tilts slightly in one direction. As Earth travels through space, there are times when the top half is closer to the Sun and times when it is further away. This top half is called the Northern Hemisphere, and is where you will find the USA.

When the Northern Hemisphere is tilting towards the Sun, it is summer in that half. This is because it gets more light and heat. Meanwhile, the Southern Hemisphere will be having its winter. As Earth moves on in its orbit and the Northern Hemisphere tilts away, the seasons will change.

It takes 365 days for the Earth to travel around the Sun

Summer
At this point in Earth's journey, its northern half is tilted towards the Sun. This means it's summer in the USA. The days are long and hot.

Spring

Here, neither the northern nor the southern half are closer to the Sun. In the USA, the days are getting longer and it's starting to warm up. Spring has finally arrived!

Winter

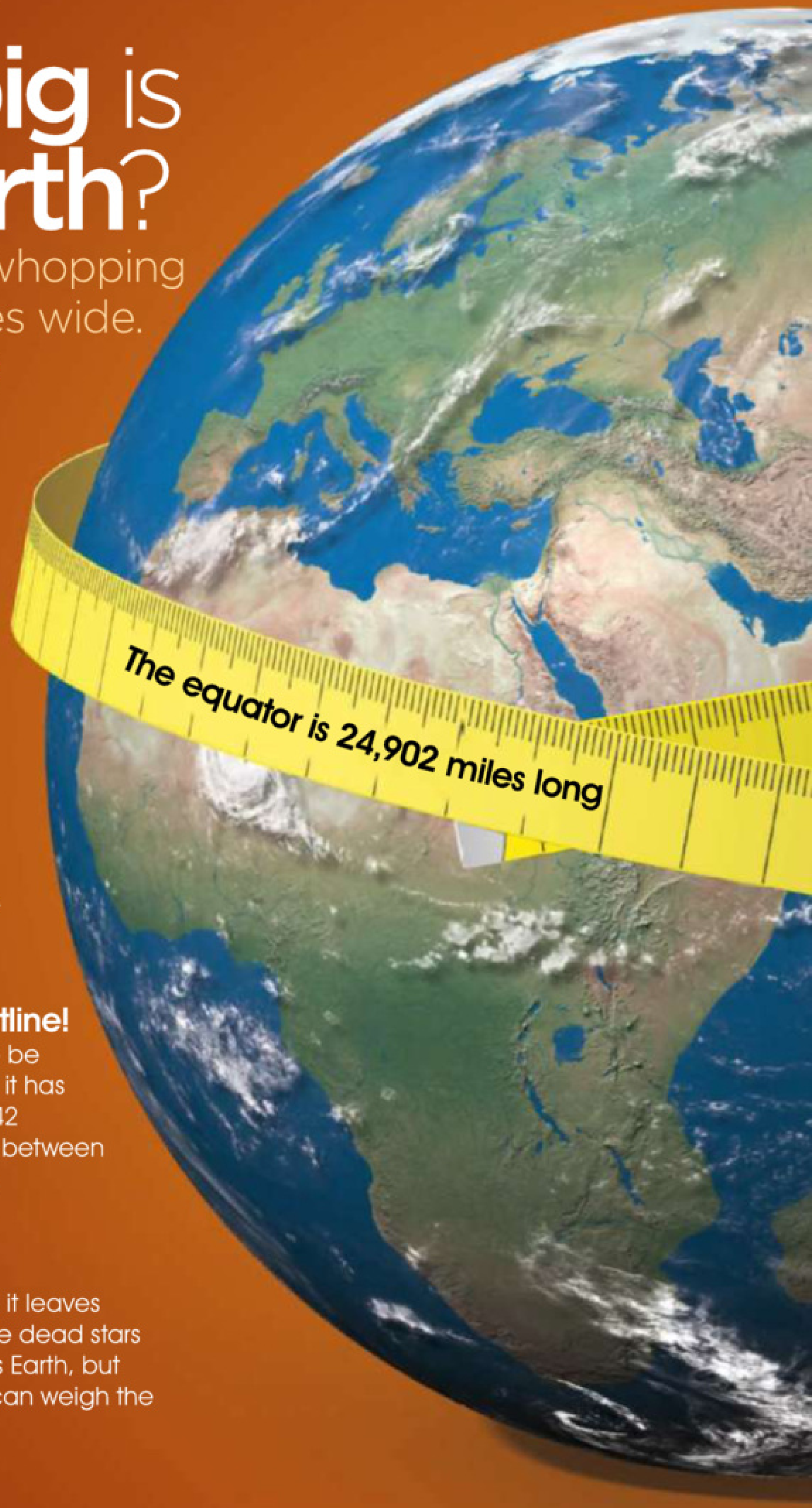
When the Northern Hemisphere is tilting away from the Sun, it is winter in the USA. It gets dark early and the Sun doesn't rise until late. It can get cold enough to snow!

Autumn

As the planet moves along, the days in the USA start getting shorter again. Trees shed their leaves ready for winter.

How **big** is the **Earth**?

The **Earth** is a whopping 12,742 kilometres wide. But it's only the **fifth-largest** planet in our **Solar System**



Earth is tiny compared with some other planets

Out of all of the planets in the Solar System, Earth is the fifth largest. It's also the biggest of the inner planets. It's beaten in size by Jupiter, Saturn, Neptune and Uranus – the outer planets.

It has a bulging waistline!

The Earth was once said to be perfectly round, but in fact it has a bulge at its equator. It's 42 kilometres wider here than between the North and South Poles.

Earth is the same size as a dead star

When a red-giant star dies, it leaves behind a white dwarf. These dead stars are about the same size as Earth, but they are very heavy. They can weigh the same amount as the Sun.

How long does it take to get around Earth?

2 days
by plane

17 days
by car

69 days
by boat

334 days
by foot

Three Earths can fit inside Jupiter's biggest storm

The biggest planet in our Solar System is Jupiter. On its surface is a violent, never-ending storm. This is so humongous that three Earths could fit inside it.

Equator

This is an imaginary line all the way around Earth's middle. It goes through deserts, jungles and even oceans

Earth's marvellous magnetism

Although you can't see it, **Earth** is surrounded by a huge **magnetic field**. This **protects** our planet from **dangerous particles** that come from space

Just like a bar magnet, Earth has a Magnetic North and South Pole. Scientists think this is all because of our planet's core. The centre of the Earth is mostly made of boiling-hot liquid iron. As this melted metal flows and the planet spins, it creates the magnetic field.

We use our planet's magnetic field for navigation because it's what makes a compass point north. It is also very important for life on Earth. The Sun releases lots of dangerous particles into space. The Earth's magnetism acts like a force field and stops them from reaching the planet.

Field lines
Tiny pieces of iron show the pattern of a magnet's field lines. Earth's field lines reach far out into space.

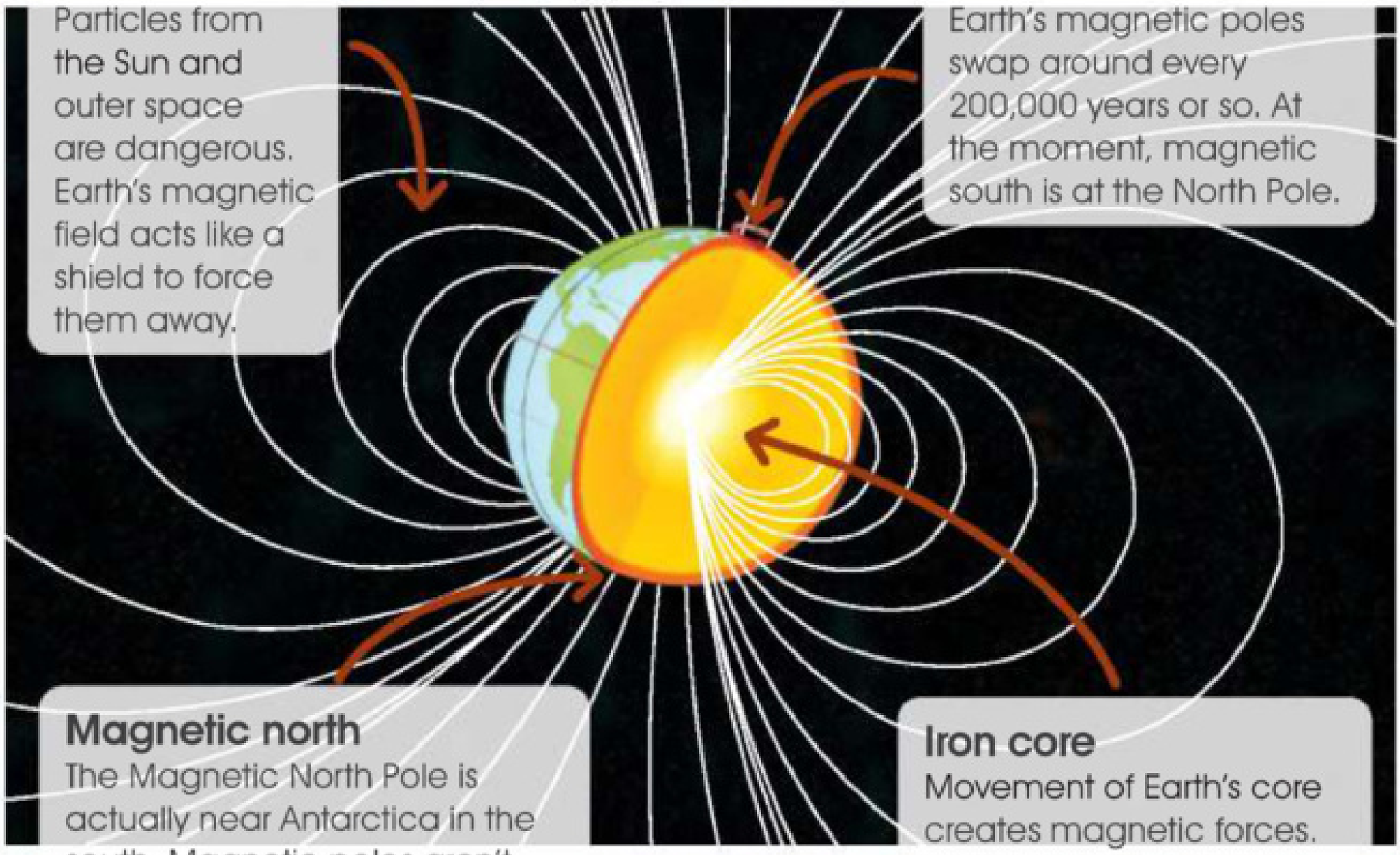
Field lines
These lines are actually invisible. They fill the space around a magnet where its forces are spread out

Earth's shield

Particles from the Sun and outer space are dangerous. Earth's magnetic field acts like a shield to force them away.

Magnetic south

Earth's magnetic poles swap around every 200,000 years or so. At the moment, magnetic south is at the North Pole.



Magnetic north

The Magnetic North Pole is actually near Antarctica in the south. Magnetic poles aren't fixed and move a bit every day.

Iron core

Movement of Earth's core creates magnetic forces. The liquid iron can reach temperatures as hot as the surface of the Sun!

Bar magnet

Earth's core acts like a bar magnet. At the surface, its magnetic field is even weaker than a fridge magnet.

Science of Earth

Why do things **fall** to the **floor**?

Earth has an **invisible force** that pulls you to the ground and makes things fall **downwards**. This is called **gravity**

Gravity was discovered by a scientist called Sir Isaac Newton. One day, while sitting in an orchard, he saw an apple fall to the ground. From this he realised that a big, heavy object like Earth pulls lighter things towards it, just like a tug-of-war team.

Everything in the universe has a gravity field, but the Earth's works on us because it's the biggest thing around. A ball thrown upwards can briefly escape the pull of gravity, but the gravity from the massive Earth pulls it back down. The bigger the thing, the more gravity pull it has.

Newton used his theories to work out the movement of other things, like stars and planets

Gravity in action

You may think that heavier things fall to the ground faster than lighter things. In fact, weight has nothing to do with it! Why not see for yourself with this simple experiment?

01 Hold out two balls

Get a friend to hold a tennis ball and football out in front of them. The bottoms of both balls need to be at the same height for this to work.

02 Get ready to drop

Lie on the ground about a metre away so you don't get hit by the balls as they drop. If you have a smartphone to video it with, all the better.

03 Watch what happens

Your friend needs to let both balls drop at the same time. Watch very carefully at this point. Which one do you think will hit the ground before the other?

04 What did you see?

Both balls should hit the ground at the same time. This is because all objects fall at the same speed, no matter what their weight is!

34kg

A 90kg person would only weigh this much on Mars. This is because it has less gravity than the Earth

Does everyone have **breakfast** at the **same time**?

Breakfast time in England
It's already 7am in England, so William is having breakfast before he goes to school.

Fast asleep in New York
Jessica is in New York, USA. It's only 2am, so she's fast asleep to prepare for the busy day she'll have!

Even though we all do things at the same **time** of day, time is **split up** across the **world**

The world is so big that not every part of it sees the Sun at exactly the same time. Because of this, the world needs to be split up into different time zones.

Think about midday. At this time, the Sun is supposed to be high in the sky. If midday were at exactly the same time for everyone all over the world, it wouldn't work. It might be midday for some people, but it would be the middle of the night for others!

A bite to eat in India

While William is having breakfast, it's 12.30pm in India, so Sana is eating lunch with her friends.

After-school fun in Japan

School has finished for the day in Japan, so at 4pm Chiyo is at her after-school art class.

How many hours of difference is there between England and India?

Email us with your answer
See page 9

Time for bed in New Zealand

While all his international friends are enjoying the day, it is 7pm in New Zealand. Dylan is getting ready for bed!

Why is the sky blue?

Light from the Sun is made up of all the **colours of the rainbow**, but blue light gets **scattered** the most. This is why the sky looks blue most of the time

01

Sunlight

Sunlight is made up of lots of different coloured light. This light travels through space to Earth.

Rainbows

When sunlight passes through raindrops, all of the colours are scattered. When this happens, we often see a rainbow.

Atmosphere

This is the name given to the layer of gases that surrounds our Earth

02

Earth's atmosphere

Our planet is surrounded by a blanket of gas called the atmosphere. When the light hits the atmosphere, it gets scattered in all directions – just like when you shake flour through a sieve.

03

Blue sky

Blue light gets scattered more than the other coloured light. This is because of the way it travels. The blue light spreads out in all directions, which is why the sky looks blue.

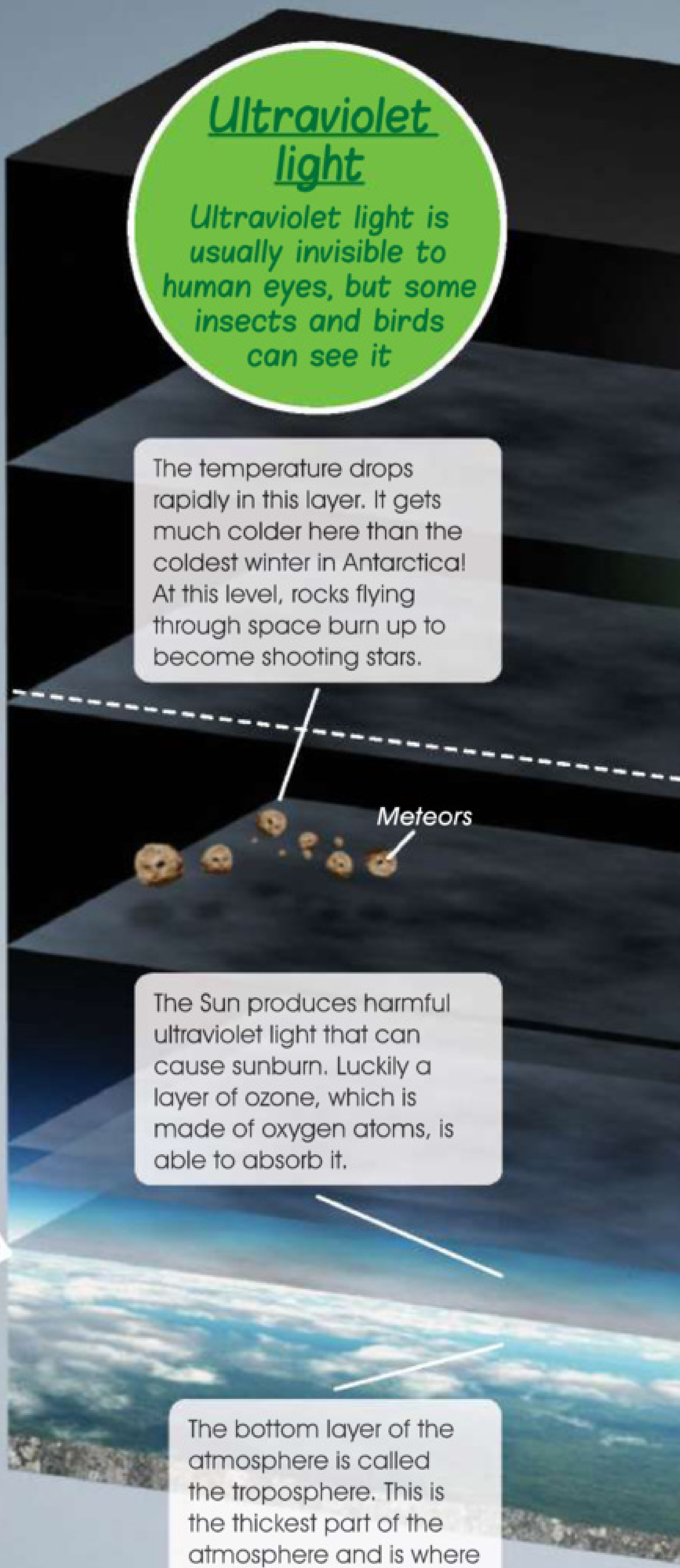
How **high** is the **sky**?

The sky, or our **atmosphere**, stretches **100 kilometres** above the surface of **Earth**. All our **weather** happens in the bottom ten kilometres

What we often call the sky is in fact Earth's atmosphere. This is a layer of gases that surrounds the Earth and makes it possible for us to live. These gases include oxygen that we need to breathe and carbon dioxide to help plants grow. There's also the ozone to protect us from harmful light from the Sun, and vapour to make rain.

Our atmosphere has three main layers to it, but all the clouds, rain and storms are in the bottom ten kilometres. The atmosphere ends about 100 kilometres above Earth. This is where space begins and is called the Karman line.

This is where the highest clouds are. But the whole of Earth's sky actually goes much higher than that



The air is very, very thin at this layer – you wouldn't be able to breathe it. At nearly 100 times the height of the highest mountain in the world, all of Earth's air finally disappears.

Rays from the Sun hitting gases in this layer create bands of beautiful light. These are called the Northern or Southern Lights. Space also begins here.

Northern Lights

Exosphere

Thermosphere

International Space Station

Space

Atmosphere

100km

Mesosphere

Ozone layer

At the top of the troposphere the stratosphere begins. Jet liners flying to other countries cruise nearly at this level, to get above the weather in the troposphere below it.

Stratosphere

20km

Troposphere

Jet liners

Earth's amazing light show

On certain nights in places near the **North Pole**, the sky lights up with **spectacular** colours. These are known as the **Northern Lights**, or **Aurora Borealis**

We all know that the Sun gives off light and heat. But it also gives off something more unusual… wind. This isn't wind like we know it though. It can't fill the sails on boats or blow over trees. Solar wind is a stream of tiny particles that travel through space. Some of these particles are electrically charged. These are called electrons.

When these electrons hit Earth's atmosphere, most of them bounce off the magnetic field surrounding our planet. But at the North Pole, there are weak spots that the electrons can squeeze through. When they come into contact with atoms in the air, they react and turn amazing colours. This can also happen at the South Pole. We call those lights Aurora Australis.

Aurora

The word 'aurora' comes from the old Roman word, which translates as 'sunrise'

47

Ten **amazing underground wonders**

Hidden **underground** are all manner of **weird** and **wonderful** things, from valuable **gems** to **dinosaur bones**, to **precious metal** like **gold** that's **worth millions**!

Gold

Most of the gold that we dig up didn't actually form on Earth. Instead it was brought to our planet by meteorites that crashed into Earth. They smashed the gold into the ground long ago.

Coal and oil

Believe it or not, coal is made from dead plants, while oil is made from sea life that died millions of years ago. That's why we call them fossil fuels!

Stalactites and stalagmites

Don't get confused between these spikes of rock found inside caves. Stalagmites point up from the ground, while stalactites have to hang on *tight* to the ceiling!

What four gems are found underground?

Email us with your answer

See page 9

Silver

Silver conducts electricity better than any other metal. If it weren't so rare underground we would be using it in all our electronic gadgets and wires!

Fossils

The dinosaurs became extinct 65 million years ago after a giant asteroid hit Earth. We know they existed because we have found their buried bones.

Molten lava

Deep underground it is hot enough to melt rock. We call this melted rock magma. When it comes up to the surface of volcanos, we call it lava.

Platinum

You probably own lots of this precious metal that we dig up from the ground. This is because platinum is used to make our computers and mobile phones.

Emeralds, sapphires and rubies

Along with diamonds, these make up the four precious gemstones. They get their beautiful colours from the different materials they contain.

Diamonds

Diamonds form really deep underground, where the temperature and pressure is incredibly high. They are then brought closer to the surface by volcanos.

Bugs

Worms and moles enjoy life in the soil, but that's nothing compared with bacteria called Desulforudis audaxviator, found over three kilometres underground!

How **big** are the **biggest crystals**?

There are crystals **more than ten metres long** and weighing about **55 tons** in the wondrous Cave of Crystals. This is **300 metres below** the **surface**

You won't find crystals much bigger than those in the amazing Cave of Crystals! This is deep underground inside a limestone cave that was filled with water for half a million years. The cave was kept warm by boiling liquid rock underneath it, called magma. This made the cave the perfect place for the crystals to grow in. Imagine the astonishment on the faces of the people who discovered it!

The crystals were discovered when all the water was pumped out of the caves. This was done to keep a nearby mine safe from flooding. Unfortunately crystals begin to break when exposed to air, so scientists are having to rush to study the cave! Eventually the water will be let back into the cave to preserve the crystals.

Above a volcano
A pool of magma beneath the cave has helped keep it warm and created an environment that the crystals love!

The Cave of Crystals is near a place called Chihuahua in Mexico

More caves

Above the Cave of Crystals is the Cave of Swords. This is filled with smaller crystals about a metre in length. There are hints that there could be other caves with even bigger crystals, but explorers haven't found them yet.

Huge crystals

The enormous crystals are some of the largest in the world. It took half a million years for them to form.

Difficult to explore

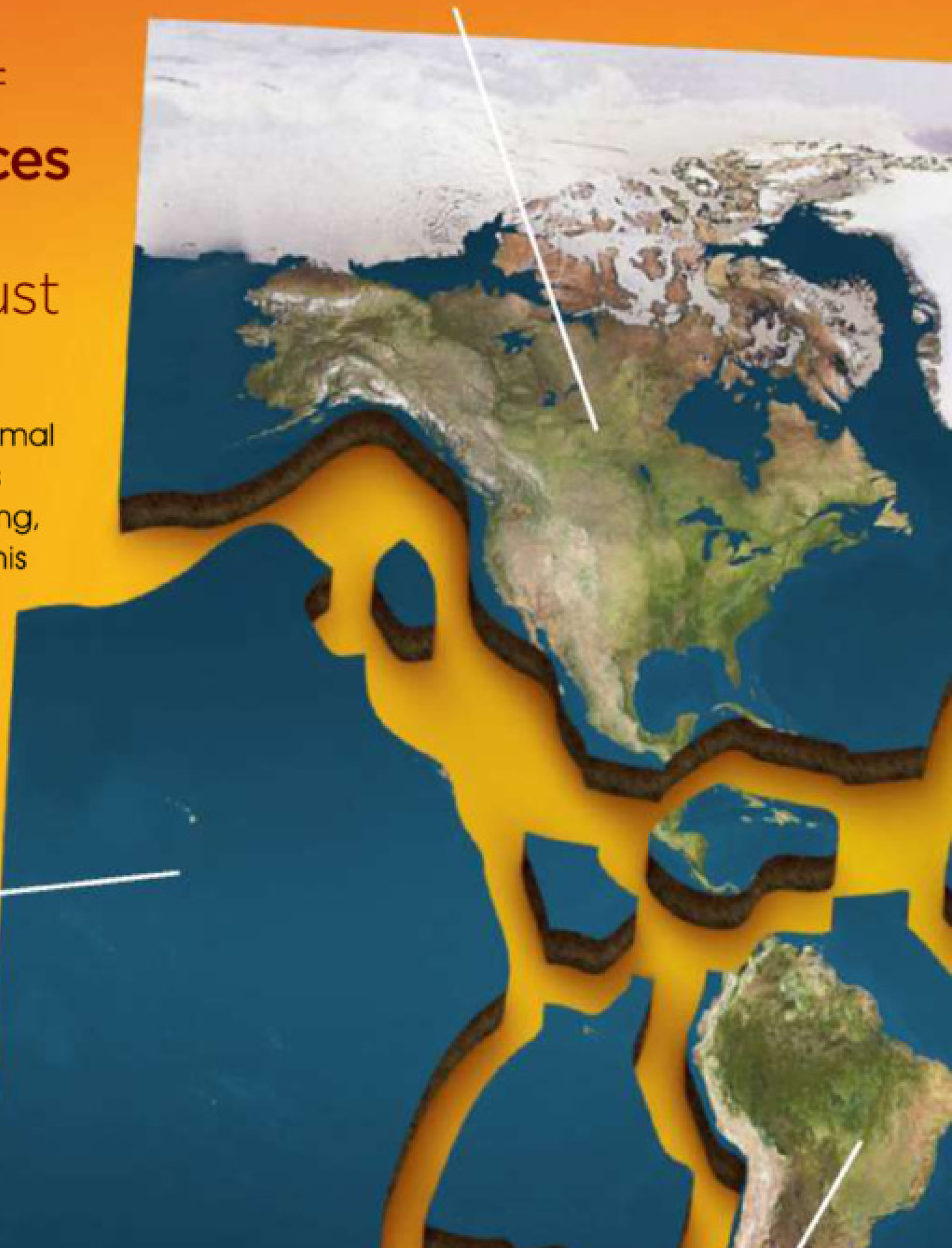
The sweltering heat makes the cave very hard to explore. The temperature is over 50°C, so explorers can only stay in the cave for ten minutes without protection.

How **Earth** is like a **jigsaw**

The **surface of the Earth** is made up of many **different pieces** called **plates**. These plates fit together just like a **jigsaw puzzle**

The surface of the Earth isn't your normal jigsaw. Oh no. In this one, the pieces are always moving around, expanding, or even crashing into one another. This happens very slowly, but it means that the shape of countries, oceans and continents will keep on changing forever.

North-American plate
The North-American plate reaches all the way from the North Pole down to Mexico. It pushes away from the Eurasian plate in the middle of the Atlantic Ocean.



Pacific plate
The Pacific plate is mostly underwater, forming the Pacific Ocean. It is still a very important piece of the puzzle, though!

Antarctic plate
The Antarctic plate moves very slowly towards the Atlantic Ocean by about one centimetre every year.

South-American plate
Earthquakes often happen where the jigsaw pieces meet. In South America, the Pacific plate actually goes under the South-American one, so the quakes there can be very powerful!

African plate

The coastlines of Africa and South America fit like jigsaw pieces because they used to be a single piece of land. The tectonic plates pushed them apart over time.

Eurasian plate

One of the largest pieces of this Earth-sized puzzle is the Eurasian plate. This reaches from the Atlantic Ocean across Asia.

Indo-Australian plate

This one actually splits in two. The top bit – the Indian plate – has crashed into the Eurasian plate. This created the Himalaya Mountains, including Mount Everest.

50 million

That's how many years it has taken the Indian plate to form the Himalayas!

What is the world's **tallest mountain**?

The **tallest mountain** in the world is **Mauna Kea** in **Hawaii**. It measures over **ten kilometres** from top to bottom and is **251 kilometres wide** at the base

The tallest mountain in the world
Mauna Kea
Though only around four kilometres of it is visible above the water level, this humongous volcano is a whopping 10.2 kilometres tall in total.

Sea level

Hawaii is a small group of islands in the Pacific Ocean

The highest mountain on Earth

Mount Everest

Everest is still the highest point on Earth, at 8.8 kilometres above sea level. It's thought to have formed over 60 million years ago!

8.8 kilometres

4 kilometres

10.2 kilometres

6.2 kilometres

How to **make** an **earthquake**

An **earthquake** happens when **two** of the **layers** in the **Earth's crust press** up against each other and **slip**. This causes **violent shaking**. Here's how to **make** your own **mini-earthquake**

The surface of the Earth is made up of plates. These plates are constantly moving, rubbing and pushing against one another with tremendous force. This movement tears apart the surface of the Earth or crunches it up. The energy from the movement travels through the ground in waves that are powerful enough to shake down buildings!

Earthquakes happen all over the Earth. There are around 200 to 250 a year, but only around 30 are powerful enough to be felt. They happen along fault lines, which are the places where the plates touch. Earthquakes can be deadly to anyone living in cities close to these lines. You can learn more about the motion of tectonic plates with this tasty experiment!

How to make an earthquake with food!

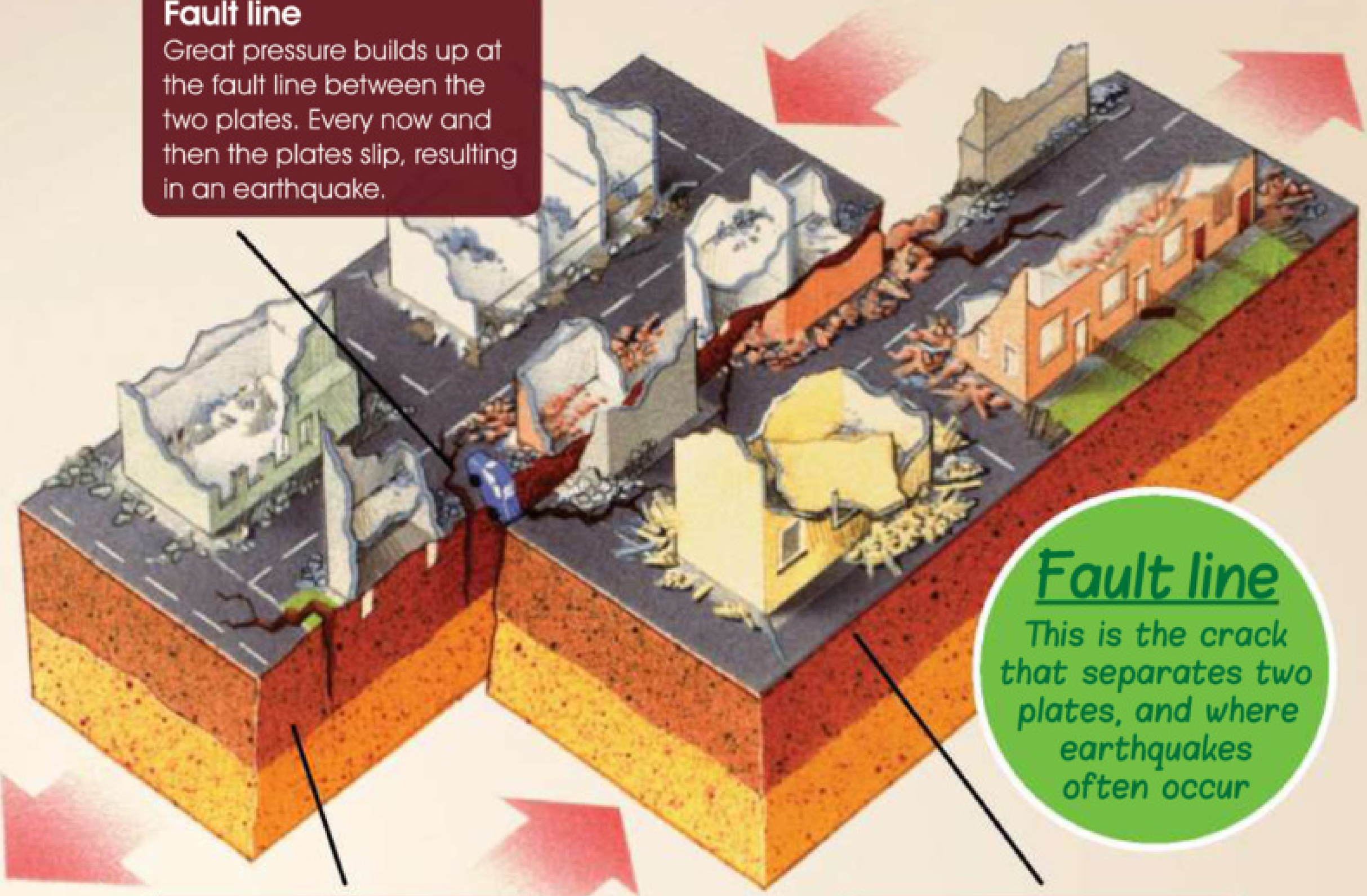
You will need

- ✔ 2 cream crackers
- ✔ Greaseproof paper
- ✔ Butter or margarine
- ✔ Glass of milk

01 Take a sheet of greaseproof paper and smear it with the butter or margarine. Then take a cracker and snap it neatly in half.

02 Push the two cracker halves together on the greaseproof paper, then slide one away from you and one towards you.

Fault line
Great pressure builds up at the fault line between the two plates. Every now and then the plates slip, resulting in an earthquake.



Fault line
This is the crack that separates two plates, and where earthquakes often occur

West plate
The western plate is moving gradually south, up against the eastern plate.

East plate
The eastern plate is moving gradually north, up against the western plate.

03 When tectonic plates move past each other like this they get stuck then slip and quickly move on. See how it's the same with the crackers?

04 Dip an edge of one cracker in some milk. Push the two together and the soft half is pushed up. This is how mountain ranges are formed.

The world's biggest waves

Tsunamis are huge **destructive waves**. They don't happen often, but can **demolish houses** and **flood entire cities!**

Tsunamis create huge tides

Just before a tsunami reaches the beach, the sea will suddenly go out very far. Then the tsunami will speed quickly back in, getting bigger the further it travels.

Earthquakes make them

Tsunamis are usually created when there is an earthquake in the ground beneath the sea. The up-and-down motion of the sea bed creates giant waves, a bit like when you splash in the bath.

We can detect tsunamis

These days we have computers that can detect underwater earthquakes and the waves they can cause. It means scientists can warn people on nearby land that a tsunami is coming.

The island of Hawaii is hit by one tsunami a year, and by a really big tsunami every seven years

524

The biggest wave recorded was 524 metres high, taller than many very tall skyscrapers

They move very quickly

These huge waves can travel very fast indeed – almost 1,000 kilometres per hour. This is much faster than the fastest car and nearly as fast as a jet plane.

What is the **biggest thing** to **hit Earth**?

A long time ago, a **gigantic asteroid** hit our planet and **wiped out** nearly all **life** on it, including the **dinosaurs**

It was much more powerful than all of World War II's explosives combined

Combine all of the explosives used in World War II and it'd be a pop compared with the great amount of power delivered by the asteroid. In fact, it was over 2 million times more powerful.

It made the sky turn very hot

Ever been told by your parents to not touch a surface because it's "red-hot"? When the asteroid crashed through the sky, it was many, many more times hotter than that surface you were warned about. It was also very red.

It killed almost everything on the planet

The impact happened a very long time ago, before people lived on Earth. Dinosaurs roamed the land, flew in the skies and swam in the seas… that is until the oceans became boiling hot and choking dust filled the air. Some small mammals, lizards and fish managed to escape the blast, though – the ancestors of today's animals and us!

It was heavier than the biggest ship in the world

The heaviest ship in the world is a supertanker named Batillus. It is 400 million times lighter than the Chicxulub asteroid.

It was even bigger than Mount Everest

Imagine Mount Everest being pulled from the ground and dropped from a great height. It would make quite an impact, wouldn't it? But this giant chunk of space rock was bigger than the largest mountain in the world by about one kilometre.

It made a very big dent that we can still see today

The asteroid hit with so much force that it left a crater called Chicxulub. This huge hole in the ground is so big that the entire island of Hawaii could fit right inside and there would still be room for more!

The Chicxulub Crater, made by this asteroid, is found in Mexico

What was the **most powerful volcanic** eruption?

One of the **most violent volcanic eruptions** in history was **Krakatoa.** This massive volcano exploded in **1883** and could be **heard thousands** of **kilometres** away

The world shook when Krakatoa erupted. The volcano in Indonesia exploded with red-hot lava and burning ash clouds. Two-thirds of Krakatoa island was blown to pieces in one of the biggest eruptions ever recorded. It was so loud that it burst sailors' eardrums on ships many kilometres away.

The tower of ash above the volcano was over ten kilometres high – taller than Mount Everest! Lava and rocks that fell into the sea made waves 40 metres high. These travelled across the ocean and destroyed everything in their path.

The blast was felt around the world

The eruption was so loud it was heard 5,000 kilometres away in Australia. It released energy in the form of shock waves that zoomed around the Earth seven times!

Growing mountain

Krakatoa is an active volcanic site that created another, smaller volcano called Anak Krakatoa. Because of the lava pushing this mountain up, Anak Krakatoa is growing by 6.8 metres a year.

It has erupted many times

Beneath Krakatoa, there is a cave called a magma chamber that constantly fills with lava. Every few hundred years, it fills up and the magma rises to the surface in an eruption.

What is **volcano lightning?**

Did you know that when **volcanos erupt**, they can be so **powerful** that they create **lightning** in the sky? This is called a **dirty thunderstorm**

Natural light show

You don't want to be near a volcano when it's erupting! It produces molten lava, heat, clouds of ash… and lightning! All the ash and rocks thrown into the air by the volcano crashes together, which creates static electricity high in the sky. As lightning is really just electricity, the conditions are perfect for amazing lightning shows!

Danger! Lava!

Lightning isn't the most dangerous thing about a volcano. Scorching-hot liquid rock called lava bursts out of them and flows down the sides. These lava rivers can destroy towns and countryside.

Dirty thunderstorm

There are three main types of volcano lightning: long lightning (which can be kilometres long), small sparks (just a few metres long) and vent lightning, which comes from the same place the lava bursts out from.

30

Kilauea in Hawaii is the most-active volcano. It has been erupting for 30 years

Strange but true

The world and the **universe** around us can be a **strange** and unusual place. Lots of **bizarre things** happen, but there are always a sensible explanations for them!

Flying frogs

There have been many reported cases of it raining fish and frogs! No one is really sure of how they get into the sky, but scientists think that tornados pick up the animals from lakes or the sea and carry them through the air.

Rolling stones

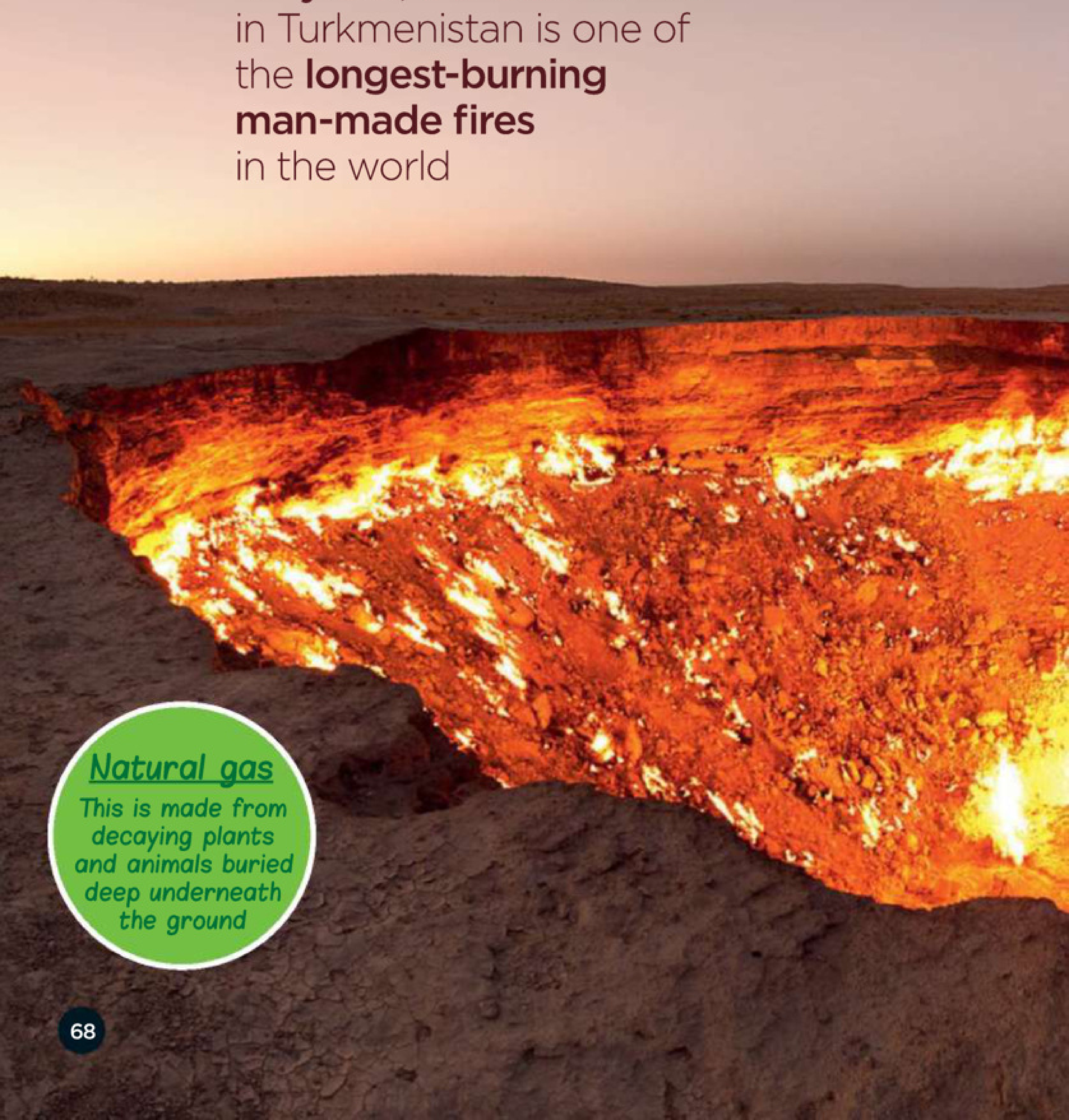
In Death Valley, California, something weird is happening… stones are moving by themselves! One explanation is that ice freezes underneath these rocks to create an ice raft. This makes it easier for the wind to blow them forwards.

Glow-in-the-dark animals

Some creatures have the amazing ability to create their own light. Some live in the sea, like jellyfish. Others are on the ground, like glowworms. This is used to attract partners, to provide camouflage, to scare off predators, or just to light up the dark like a torch!

What's the **longest-burning** fire?

After blazing for over **40 years**, the Door to Hell in Turkmenistan is one of the **longest-burning man-made fires** in the world



Natural gas

This is made from decaying plants and animals buried deep underneath the ground

Back in 1971, geologists were drilling for gas in Turkmenistan when the ground caved in. This made a great big hole in the desert. Nobody was hurt, but lots of dangerous gases that were hidden under the ground suddenly came out.

Geologists were worried about these poisonous gases that the pit was giving off. They decided that the best way to get rid of the fumes was to set it on fire. The geologists hoped that it would burn off in a few days, but it's still burning 40 years later!

The big blaze

The crater is over 70 metres wide and a huge 20 metres deep. There isn't even a barrier to stop people from falling in!

The Door to Hell

People from the nearest village of Derweze named it the Door to Hell because of the boiling mud and bright flames.

Fuel the fire

The fire keeps on burning because there are lots of natural gases to fuel it, like methane and sulphur.

How much **water** is there on **Earth**?

Our planet has a lot of water... 326 million trillion gallons to be exact. But if **Earth** were the size of a **basketball**, all of its **water** would fit into a **snooker ball**

There's plenty of water, but hardly any is drinkable
96% of water on Earth is salt water in the oceans. These oceans can be 11 kilometres deep, but this water isn't drinkable.

The Earth's oceans look never-ending, but most of our planet is made up of rock and metals

Most of the fresh water is locked away
There is a lot more drinkable water below the ground than there is in the rivers and lakes. Even more of it is frozen in the icecaps and glaciers!

It can rise into the air
When water heats up it can become light and rise into the air. This is called water vapour. A lot of the water on Earth is floating around in our atmosphere.

Thin skin

Our planet is huge. But the Earth's crust, which is the outer layer that holds the oceans, is thin compared with the other layers. It's like the skin on an apple!

We're mostly water!

You might feel solid, but around two thirds of your body is made up of water! That's why it's so important for us to drink plenty every single day.

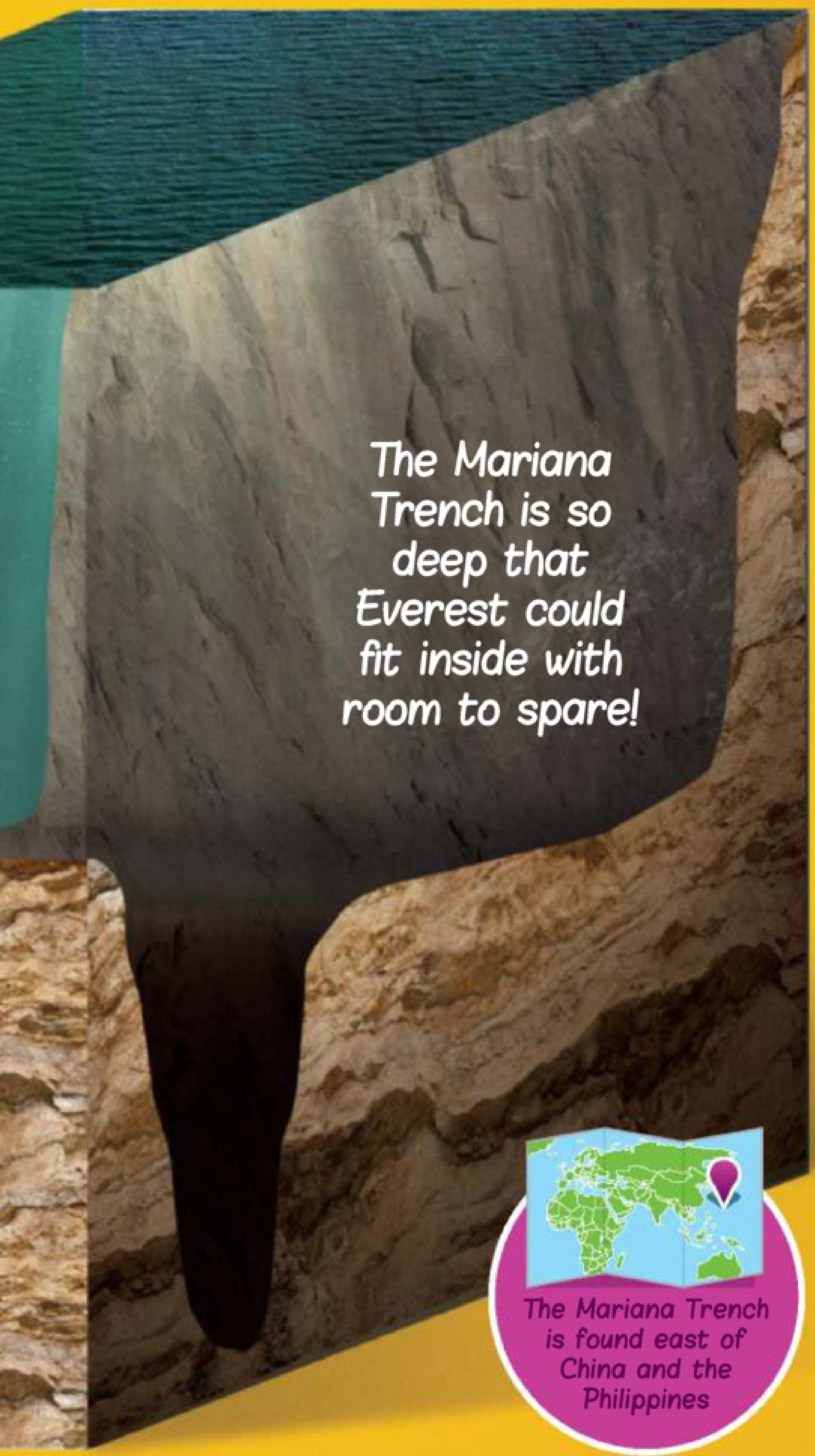
How **deep** is the **deepest ocean**?

The **deepest** part of the **ocean** is in the **Mariana Trench** and is called the **Challenger Deep**. It goes down so far that few people have **seen the bottom**!

Deeper than 13 Burj Khalifas

The Burj Khalifa is the tallest building in the world. 13 of them could fit one on top of the other inside the Mariana Trench.

5 facts about the Mariana Trench



It was formed by movements of the Earth's surface

Continents and sea floors move around on plates. When these overlap, one can force another down underneath it, creating deep trenches.

It's pitch black

Sunlight doesn't pass further than 200 metres below the sea's surface, so no light at all reaches the Mariana Trench.

The pressure is immense

The water pressure here is about the same as if you had 50 jumbo jets stacked on top of you!

Few humans have explored it

So far, only three people have visited the trench in special submarines. More people have walked on the Moon!

Life exists there

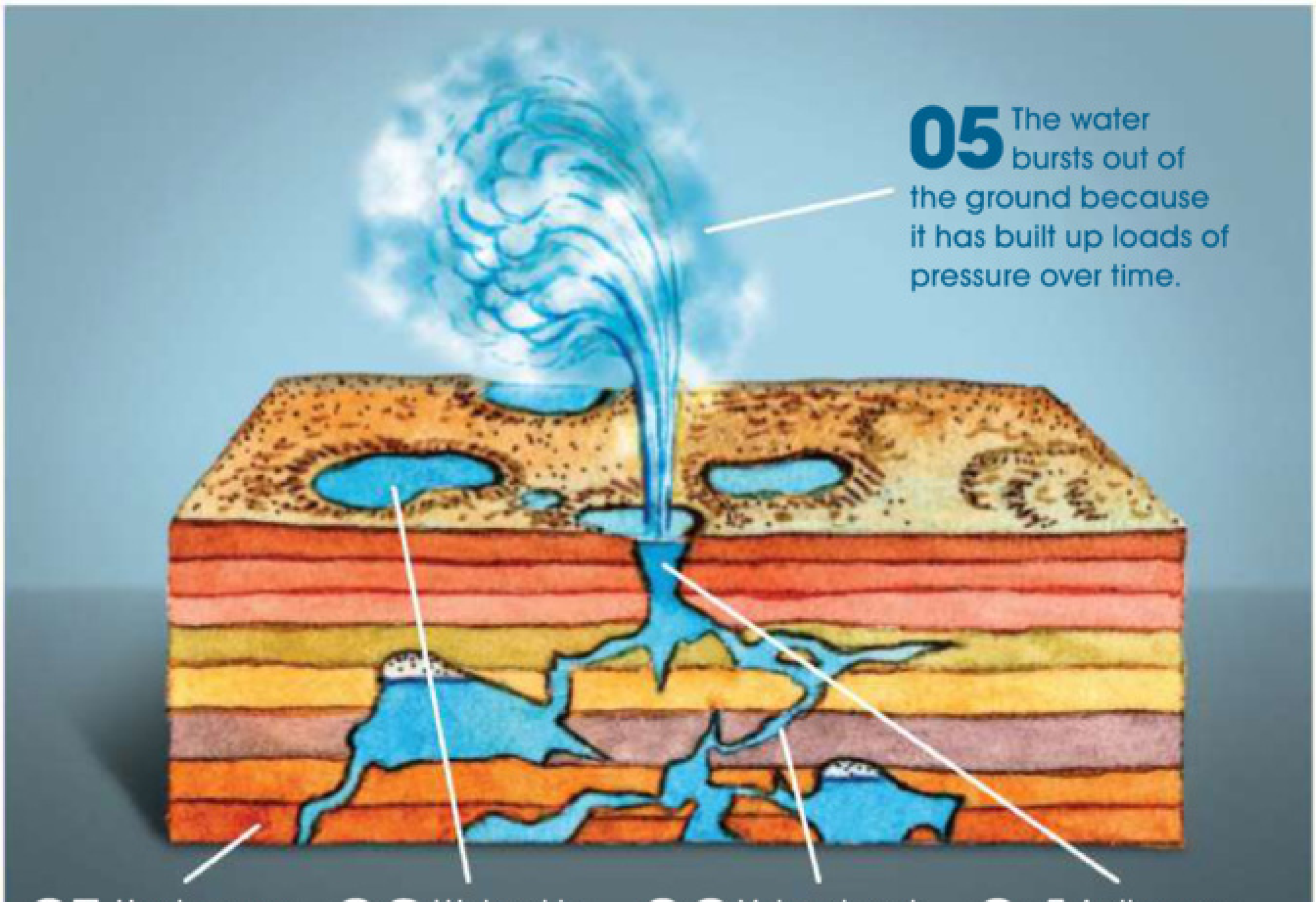
Against all odds, some bacteria and animals like sea cucumbers manage to survive in the trench's extreme conditions.

Why do **geysers shoot water** from the ground?

In certain areas of the world, **huge fountains** of **water** can **spray out** of the **ground**. This water has been forced out by very **high pressure**

Geysers are always found in rocky places, and often near volcanoes. This is because the ash from an exploded volcano is a really important part of how a geyser works. Water in the ground is heated to very high temperatures by super-hot magma from the Earth's core. As water drips through the rock, it warms up.

The hot water begins to rise and ash is dissolved into the water. It is then left on the sides of rocky passages, increasing pressure because there's less space for water to move through. Once the water finally reaches the top, the pressure drops quickly and it bursts out of the ground in the form of steam.



05 The water bursts out of the ground because it has built up loads of pressure over time.

01 Heat comes from the scorching-hot liquid magma that is always in the Earth's core. This heats the water.

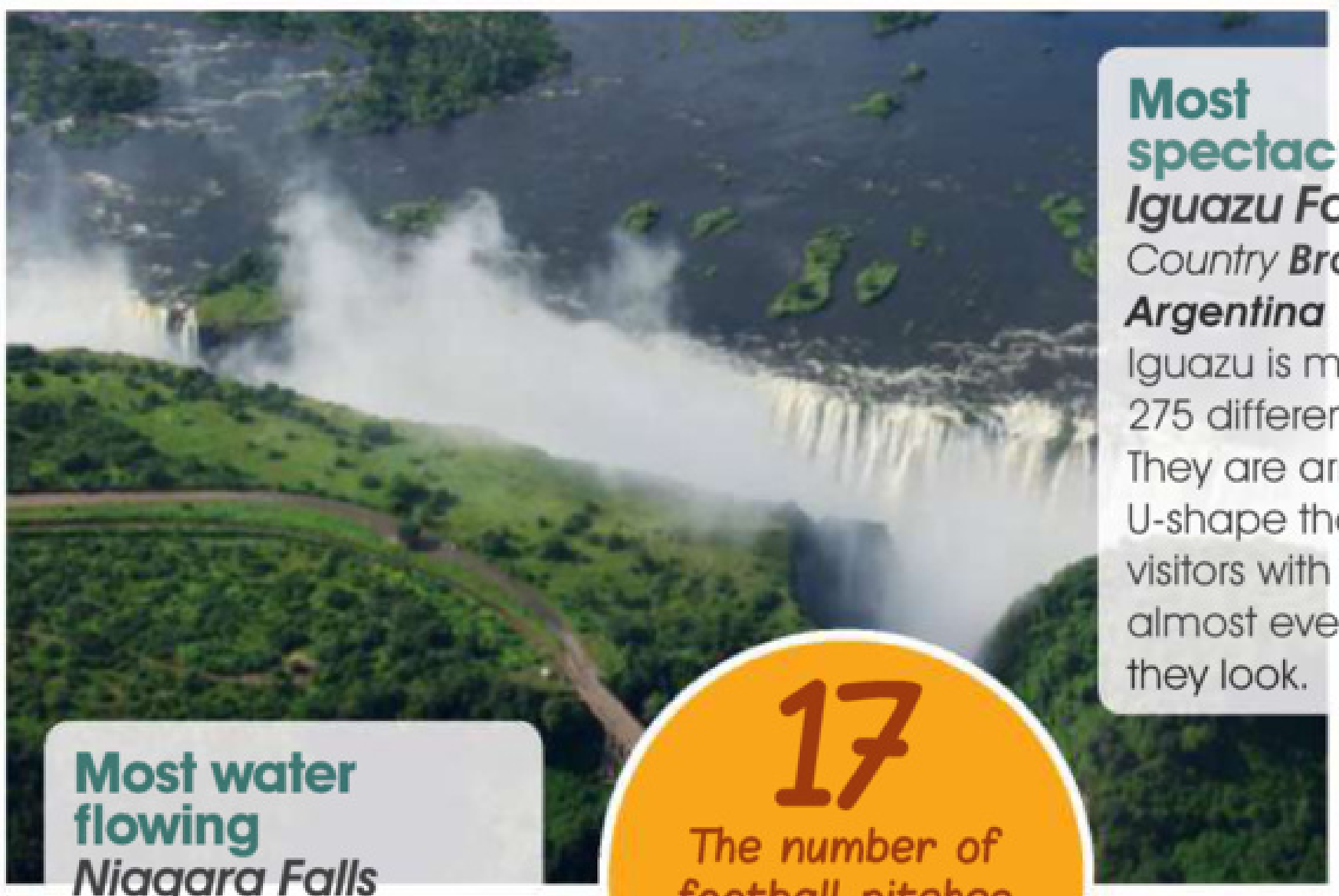
02 Water drips through the rock from the surface, gets heated, then rises up to where the pressure is lower.

03 Volcanic ash gets caught by rising water and left in the passages. This makes them smaller, increasing the pressure.

04 As the very hot water reaches the surface of the Earth, there is suddenly loads more room, so the pressure drops really quickly.

What is the **world's biggest waterfall**?

Waterfalls are among the most **impressive natural wonders** in the world. Some are **taller** than **skyscrapers** and others can fill a **swimming pool** every **second**



Most spectacular

Iguazu Falls

Country ***Brazil / Argentina***

Iguazu is made up of 275 different drops. They are arranged in a U-shape that surrounds visitors with waterfalls in almost every direction they look.

17

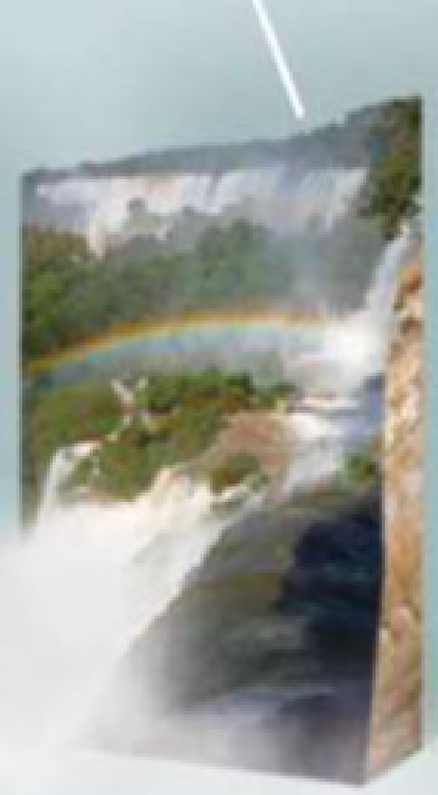
The number of football pitches that could fit in Victoria Falls' curtain!

Most water flowing

Niagara Falls

Country ***USA / Canada***

Every second enough water flows over the Niagara Falls to fill an Olympic-sized swimming pool. Over 12 million tourists visit this natural wonder every year.



Tallest

Angel Falls

Country ***Venezuela***

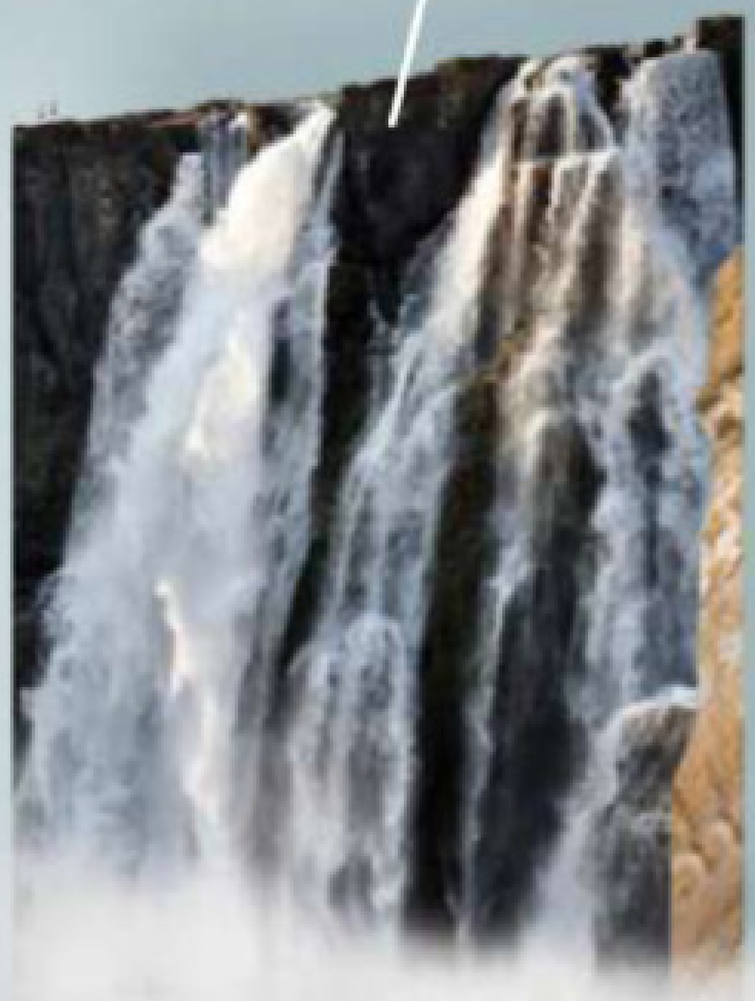
At almost a kilometre high, Angel Falls is higher than the world's tallest building. The water turns to mist before it has even reached the ground.

Largest curtain of water

Victoria Falls

Country ***Zambia / Zimbabwe***

Victoria Falls in Africa is neither the tallest nor the widest waterfall, but its huge drop creates the largest curtain of falling water on Earth.

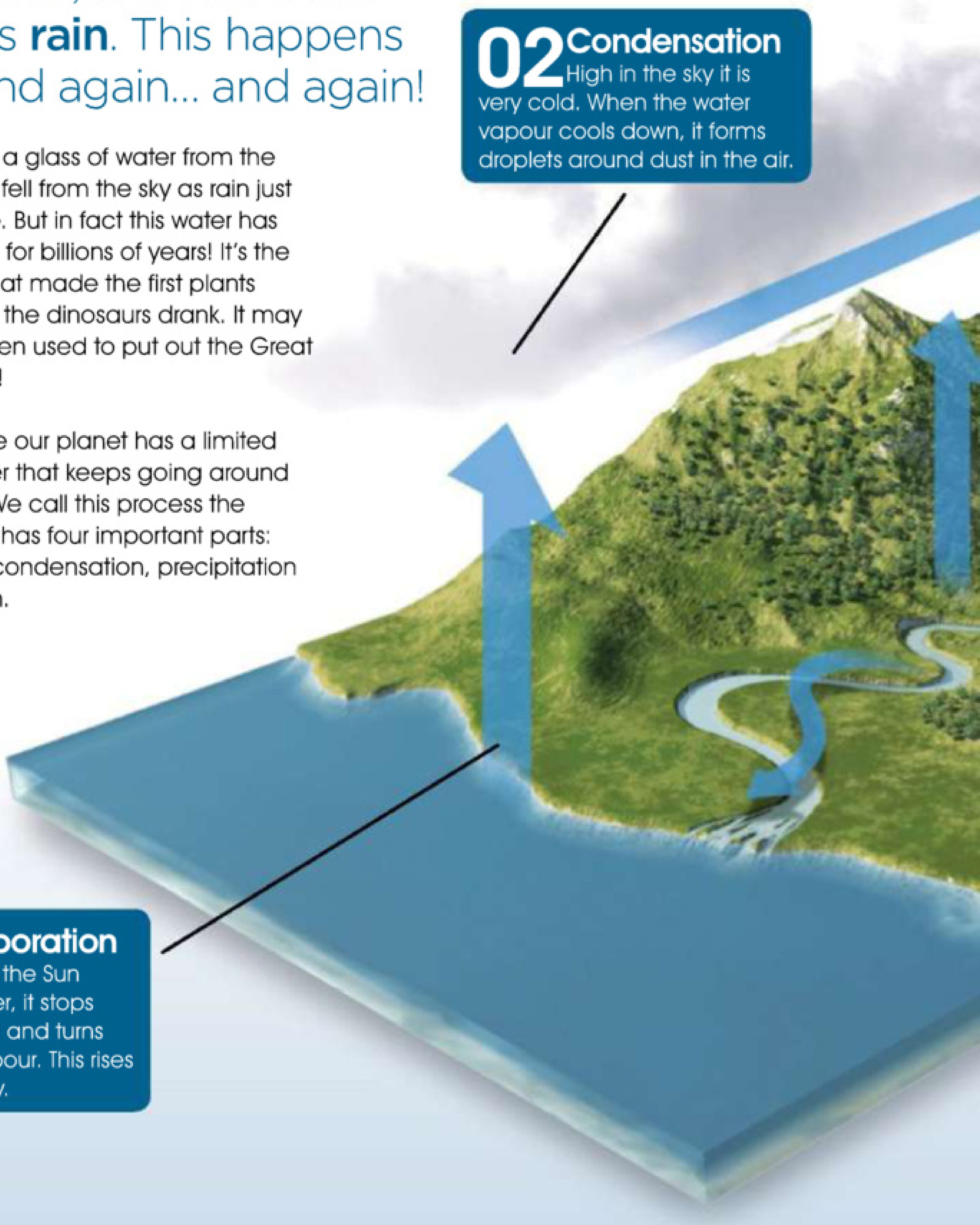


Where does **rain come from?**

Water rises into the **sky**, turns into **clouds**, and falls back down as **rain**. This happens again and again... and again!

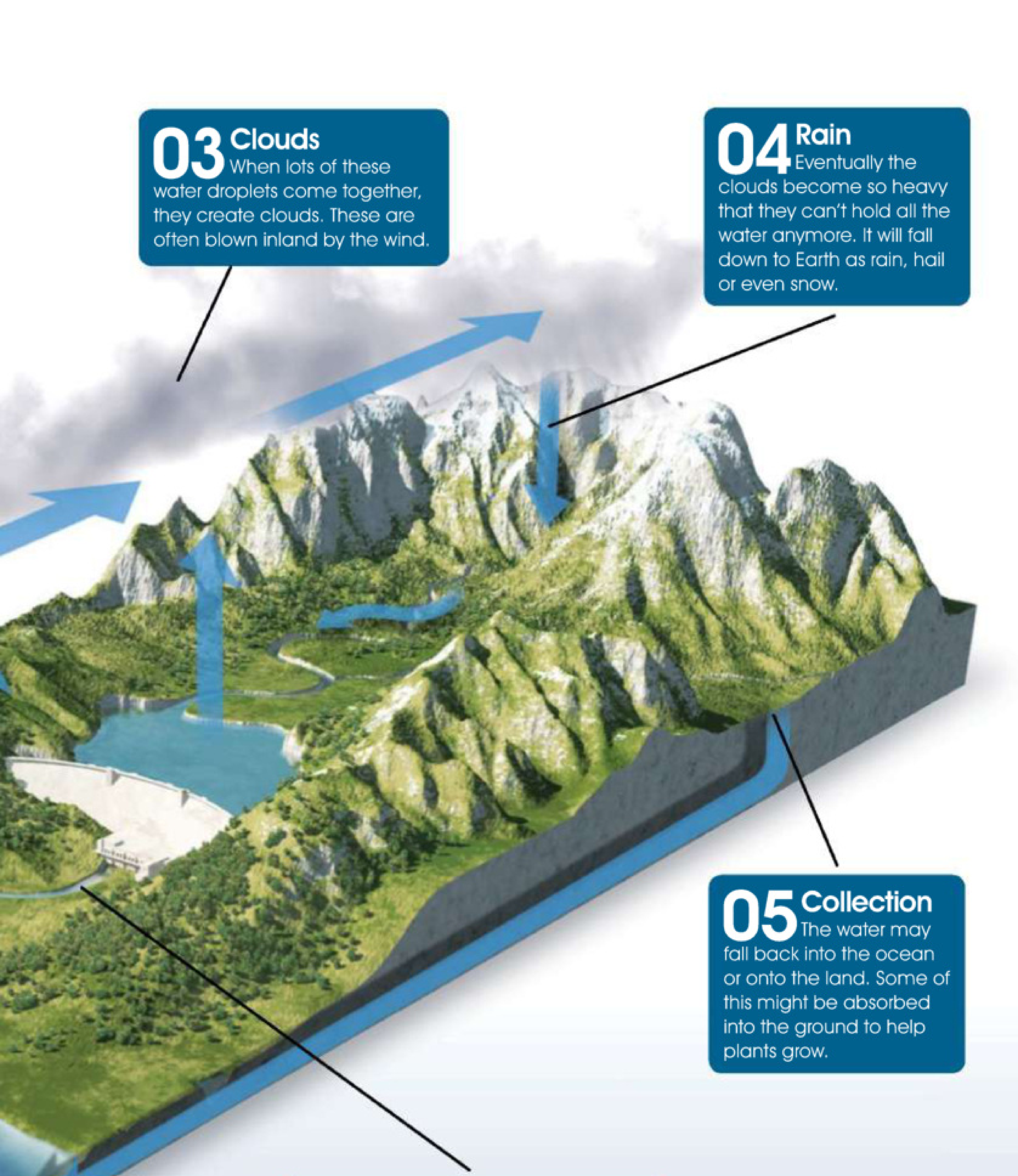
When you get a glass of water from the tap, it's likely it fell from the sky as rain just a week before. But in fact this water has been on Earth for billions of years! It's the same water that made the first plants grow and that the dinosaurs drank. It may even have been used to put out the Great Fire of London!

This is because our planet has a limited supply of water that keeps going around and around. We call this process the water cycle. It has four important parts: evaporation, condensation, precipitation and collection.



02 Condensation
High in the sky it is very cold. When the water vapour cools down, it forms droplets around dust in the air.

01 Evaporation
When the Sun heats up water, it stops being a liquid and turns into water vapour. This rises up into the sky.



03 Clouds
When lots of these water droplets come together, they create clouds. These are often blown inland by the wind.

04 Rain
Eventually the clouds become so heavy that they can't hold all the water anymore. It will fall down to Earth as rain, hail or even snow.

05 Collection
The water may fall back into the ocean or onto the land. Some of this might be absorbed into the ground to help plants grow.

06 Streams and rivers
The rest of the water runs over the soil to create streams and rivers. These flow back down to the ocean.

How to **make** a **cloud**

Clouds are formed when **water vapour** in the sky **cools down**. You can use **ice cubes** to **make one yourself!**

Clouds are very important to life on Earth. They contain something that every person, animal and plant needs to survive… water.

When water heats up, it evaporates and rises into the air as vapour. This is a gas and is invisible to us.

High in the sky it's very cold. When the water vapour reaches this height, it cools and clumps together to form clouds. This process is called condensation.

Try making your very own clouds with this easy experiment, which you can do at home.

You will need

- ✔ A see-through, heat-proof container
- ✔ Heated water
- ✔ A small metal or foil dish big enough to cover the entire top of the container
- ✔ Ice cubes

Make your own cloud

Don't try this at home without an adult

01 Place the ice cubes on the metal or foil dish to cool it down, just like the cold air up in the sky. Make sure the ice cubes can't spill out of it.

02 Put a little bit of the hot water into the heat-proof glass. Make sure you don't fill the glass, and don't burn yourself!

Evaporation

This is what happens when water heats up and turns into a gas

Make it rain
When the clouds have become thick enough, the vapour changes into liquid water drops again and falls as rain.

Clouds form
When the vapour stops rising, it forms the clouds we can see drifting above us. The thicker and warmer ones become dark.

03 When the ice has made the metal dish very cold, place it carefully on top of the glass. The dish will need to cover it completely.

04 Soon you should see a small cloud form just underneath the dish. As the hot water in the glass evaporates and rises, it condenses.

How **big** can **hailstones** become?

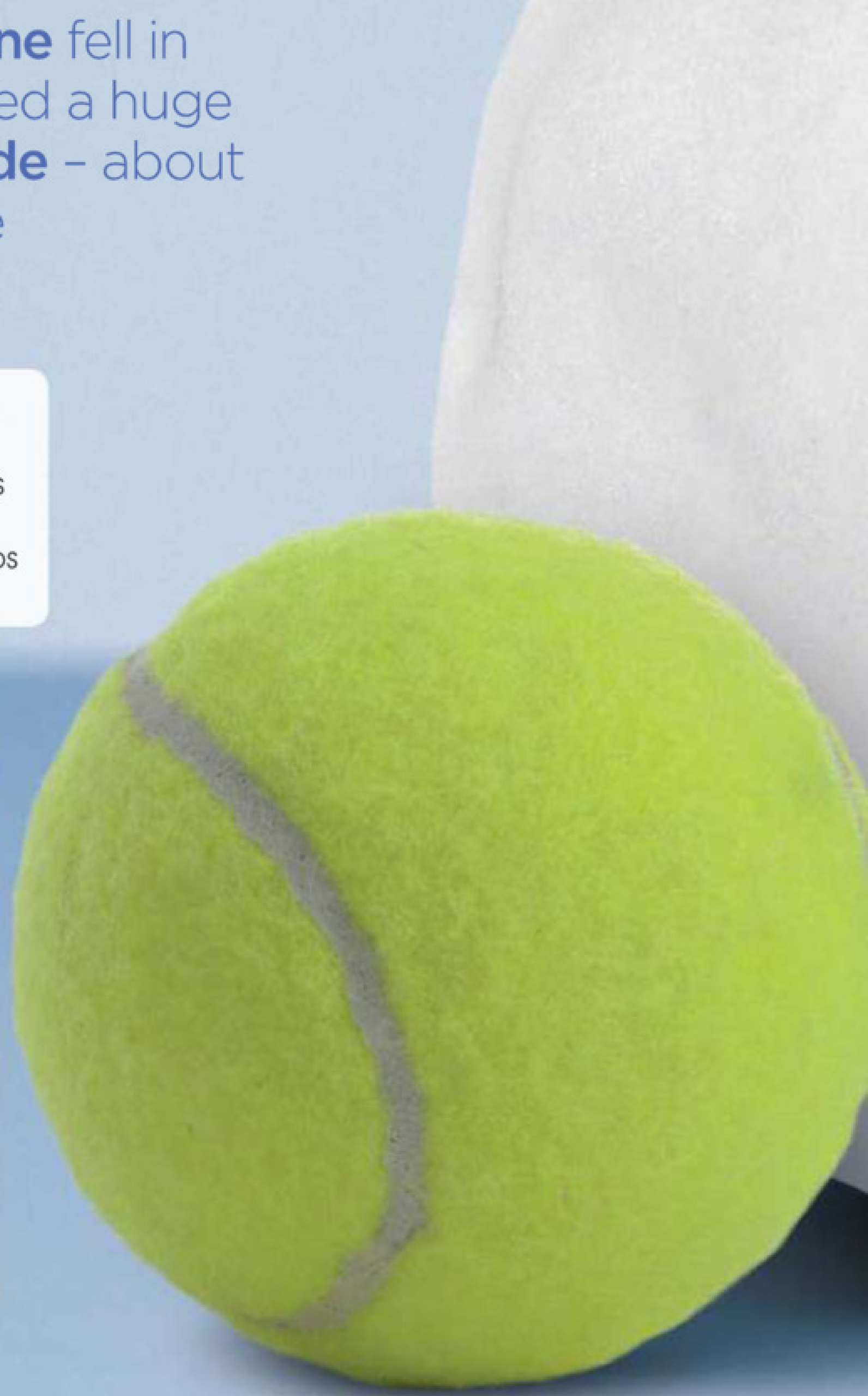
The **largest hailstone** fell in the USA. It measured a huge **20 centimetres wide** – about three times as wide as a tennis ball

Beware… hailstorm!

The biggest hailstone weighed almost a kilogram – the same as a pineapple. Heavy hail like this can smash windows, flatten crops and even knock people out!

How are they formed?

Inside a storm cloud, warm air carries water droplets high into the cold area at the top where they freeze. The frozen droplets are carried down to the bottom by cold air, where the warm air takes them back up again. This can happen many times, adding layers until the droplets get too heavy and fall to the ground.



160km/h

Hailstones can fall at nearly the same speed as a very fast car!

Snow difference?

Hail and snow have the same ingredients, but they look and feel very different. This is because they are created in the clouds in different ways. Snow is made up of ice crystals that stick together, while hail is a ball of ice.

What can **lightning** strike?

A **lightning storm** is one of nature's most **powerful** wonders. Lightning bolts often strike **tall metal objects** like skyscrapers, pylons and even planes!

Lightning is a very powerful charge of natural electricity. It is created in a storm cloud, where water droplets rubbing against one another create a negative electric charge. If the charge gets big enough, it will be attracted by positively charged objects on the ground. These will shoot down to hit them.

The charge racing down from the sky is what we see as lightning. We can't see any other part of this process because the positive and negative charges are invisible. Thunder is the sound that the lightning makes. Because sound moves much slower than light, we always see lightning several seconds before we hear its thunder.

16km

Lightning can strike this far away from the storm cloud it comes from

Trees

Lightning often hits trees in the countryside, where there are no other tall things around.

Planes

Aeroplanes can be hit by lightning and continue to fly.

Clouds

Lightning can strike inside a cloud, so we don't always see it.

Skyscrapers

These usually have metal lightning rods on top to stop them catching fire.

Pylons

If lightning hits an electricity pylon, entire towns can lose power!

Monuments

The Eiffel Tower in Paris is made of metal and prone to lightning strikes.

People...

Luckily the chance of this happening is only one in a million!

Photo: Tom Bresson

How **fast** can **wind** go?

A **gentle breeze** travels about the same speed as a **bicycle**, but a **tornado** can move **40 times** as fast!

America's record wind speed

371 kilometres per hour

The highest wind speed ever recorded in the USA was 371km/h on Mount Washington. That's about as fast as the top speed of a high-end sports car.

The most-powerful hurricane

294 kilometres per hour

The most powerful hurricane on record was Hurricane Wilma in 2005. A falcon dives through the air at about the same speed as it moved!

The speed of wind in a British storm

128 kilometres per hour

The average speed of the wind during a storm in the UK is 128km/h. That's the same speed as a cheetah can run.

Hurricanes

These are powerful storms with very strong winds. They can cause huge destruction

The fastest tornado

511 kilometres per hour

The fastest tornado on record was in Oklahoma City, USA.

The world's most-powerful storms

Super Typhoon Nina
1975 China

There was so much rain in this storm that it burst over 60 dams. These flooded the area and destroyed 6 million buildings.

Bhola Cyclone
1970 Bangladesh

This powerful cyclone hit a very low and flat part of the world. It created giant waves that destroyed fields and made millions of people homeless.

The Great Hurricane
1780 Caribbean

This gigantic hurricane happened before the USA was even founded. It flattened sturdy stone forts, lifted cannons and stripped bark off trees.

Iran Blizzard
1972 Iran

The winter of 1972 brought a snow storm to Iran. The powerful winds dropped thick snow, destroying roads and telephone lines.

Can a **tornado** pick up a **house**?

Most tornados are small, but some are very **strong** and can pick up a house, **dropping** it **several streets** away!

Tornados are columns of fast-spinning air that stretch down from a thunderstorm to the ground. They are created when very warm, wet air meets cold, dry air. The warm air moves up through the cold air where the wetness creates a thunderstorm. The warm air continues to move quickly upwards and begins to spin, creating the twisting column of a tornado.

Small tornados can be around the same width as a house, but big tornados can grow to a size of more than one kilometre wide. They can also move fast, from 50 kilometres per hour – a bit faster than the fastest man in the world – to faster than a speeding cheetah, at 100 kilometres per hour. Tornados can pick up almost anything in their path, including houses.

Cows
A tornado once ripped through a farm, tore the buildings apart, then sucked up the cows and dropped them in another field.

People
Seven-year-old Jamal Stevens was sucked out of his bed by a tornado and flung out onto the grass. He was lucky to survive.

Fish
When tornados move across the sea they're called waterspouts. They can suck up the water and everything in it. In 1947, one of these waterspouts sucked up fish and dropped them all over a town in Louisiana.

Lorries
In 2012, a huge tornado sped through a roadside car park. It picked up lorries and trailers and threw them right across the road like plastic toys.

In 2009, a tornado picked up a mobile home, with a family inside, and threw it across the street. Although some of the family were injured, they all survived

Six amazing things made by the weather

The **wind** and the **rain** are amazing **natural artists**. They can carve tough rocks into **beautiful shapes**. This is known as **erosion**

01 Antelope Canyon

Arizona, ***USA***

This winding, sandy canyon was made by flash floods during the monsoon season. The heavy rainwater ran through the rocks and carved out the gaps between them.

02 Devil's Garden

Utah, ***USA***

These rocks in the desert have been sculpted into fantastic columns and bridges by the wind. The giant sculptures are known as hoodoos.

03 Monument Valley

Arizona, ***USA***

This famous valley is seen in lots of cowboy films and was carved by rivers long ago. The hard sandstone did not erode as easily and created mountains over a kilometre high!

04 Saharan rocks

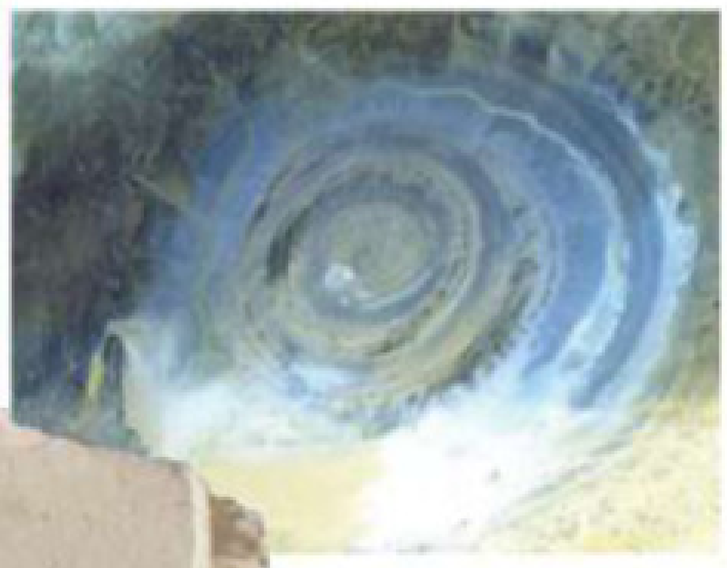
Sahara desert, ***North Africa***

In the Sahara desert the temperature is usually over 30°C! Luckily there are these wind-carved rocks to provide shade.

05 Eye of the Sahara

Sahara desert, ***North Africa***

This dome of rock has been eroded by the wind, making it look like a gigantic dartboard in the desert.



06 Limestone umbrellas

White desert, ***Egypt***

These strange-looking objects are made of tough limestone rock.

What would **fit inside** the **Grand Canyon**?

The **Grand Canyon** was carved out by a **river** in a process called **erosion**. It gradually **broke down rock** to create a **long** and **deep crack** in the ground

1,100 trillion gallons of cola

If the Grand Canyon were full of cola, it would take the population of the USA nearly 78,000 years to drink it all!

The Grand Canyon is found in northern Arizona, in the west USA

It's so deep, it's hard to see the bottom of the Grand Canyon from the top

Erosion

This is when Earth's surface is worn away by ice, water, wind and soil

The canyon is 446 kilometres long

The Grand Canyon is nearly as long as England. It would stretch from London all the way up to the border with Scotland in the north!

It's 29 kilometres wide

Crossing the canyon at its widest point would be the same as racing around an Olympic running track 72 times!

It's over 1,600 metres deep

This is nearly eight times deeper than the world's deepest river, the Congo in Africa.

Six million years

It took 5 to 6 million years for the Colorado River and the streams that run into it to wear away the rock and create the canyon we see today.

It can be seen from space!

The canyon is so massive, it can even be seen by the International Space Station that orbits the Earth.

How **cold** is the **North Pole**?

In winter the North Pole is **minus 40°C**. That's very chilly, but how does it **compare** with other **freezing-cold things**?

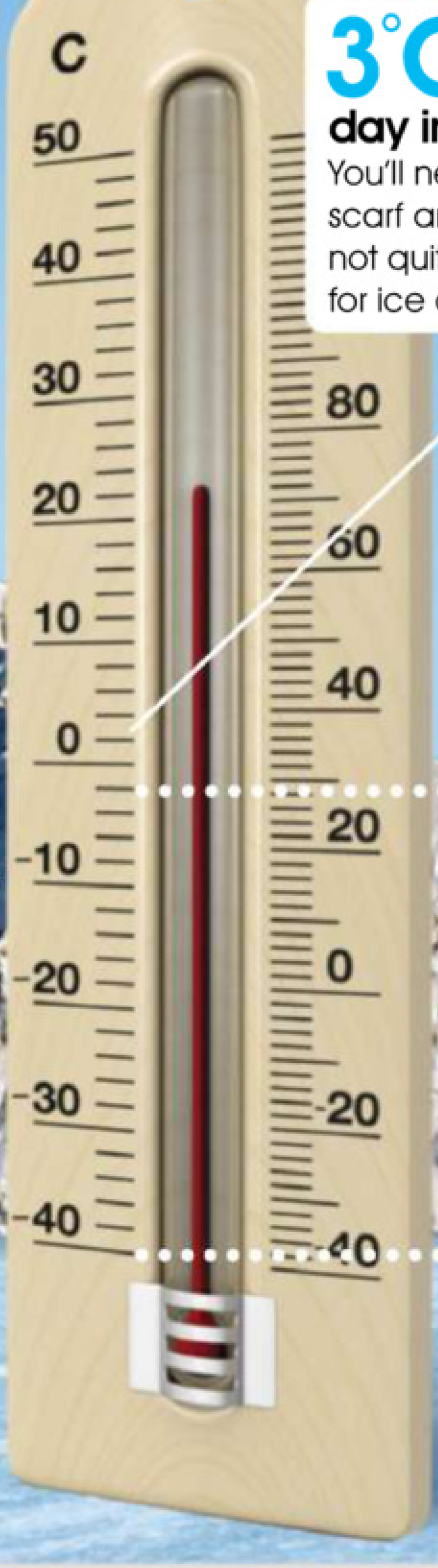
-18°C Freezer
This is probably the temperature in your freezer at home. Keeping food cold stops it from going mouldy.

-10°C
Ice cream
At this temperature your frozen treat will be soft enough to scoop, but firm enough to stay on your cone.

-28°C At the top of Mount Everest
Up here the air is so thin that it can't warm up much. Climbers have to wear special suits so they don't get frostbite.

-1°C Snowman
Just below freezing there's still some moisture to hold the snow together. Any warmer and Mr Frosty would melt!

3°C Average winter's day in England
You'll need to wear a scarf and gloves, but it's not quite cold enough for ice and snow.



-40°C
The North Pole is this cold in the winter

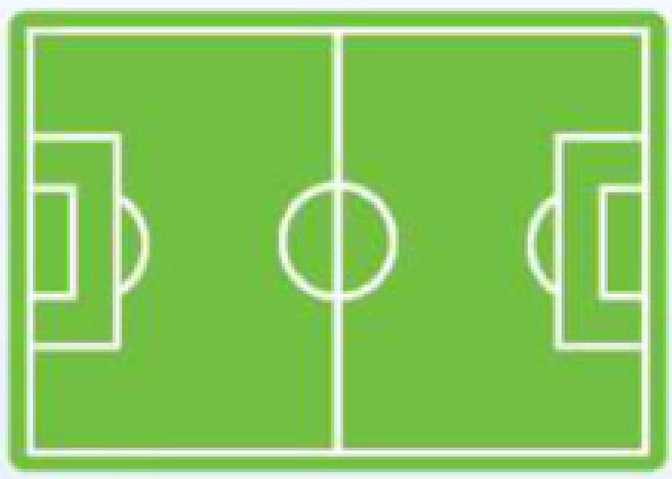
What is the **biggest iceberg**?

The **Titanic** was famously sunk by an **iceberg**, but there have been even bigger icebergs prowling the seas. One called **Iceberg B-15** was **larger** than the island of **Jamaica**!

Iceberg B-15

1,571

Overall, Iceberg B-15 was the same size as this many football pitches!



When icebergs melt, they make a fizzing sound!

The ice inside icebergs contains bubbles of air trapped inside. When the iceberg melts these bubbles burst with a popping or fizzing sound!

From tabletops to domes, wedges and spires

Icebergs come in all shapes and sizes. Some have steep sides and flat tops like a table. Others are rounded, spiky or blocky, or have gaps missing from erosion.

What we see above water is just the tip of the iceberg!
Icebergs are so big that the ice we see floating above the water in only one-tenth of their true size. The rest is hidden under the water.

It was taller than the tallest building in Britain
The highest skyscraper in Britain is the Shard, which is 306 metres tall. But this is shorter than Iceberg B-15's height, which was about 350 metres. Only 37 metres of that popped up above the water

Global warming makes more icebergs
As the Earth warms up, the ice at the poles is melting. Huge icebergs are breaking off glaciers. Scientists are measuring icebergs to keep an eye on global warming.

Eight cool facts about glaciers

Glaciers are like **huge rivers** of **ice** that **flow very, very slowly**. They are created over **hundreds** of **years** from snow that turns into ice

01 Glaciers flow like rivers

We might think ice is hard, but compared with rock it isn't. Icy glaciers can flow very slowly down mountains and valleys, carving the landscape as they go.

02 They move about a metre each day

Because of all the weight stacked on them, glaciers move really slowly… maybe only a metre every day. The fastest ever glacier was the Kutiah Glacier in Pakistan, which in 1953 moved 12 kilometres in three months.

03 Glaciers created Britain

From the craggy Scottish highlands and the rolling hills of northern England, to the relatively flat areas further south, glaciers carved them all during the last ice age. They flowed southwards before melting and depositing giant boulders that they had carried with them.

04 They once ruled the Earth

10% of Earth's land is covered by glaciers, covering 15 million square kilometres in total. However, during the last ice age that ended around 12,000 years ago, they covered over 3 times more surface area than this.

05 Glaciers can be several thousand years old

06 Global warming is destroying them

Since the start of the 1900s, glaciers have begun shrinking at an alarming rate as they melt faster than ever before. This is being blamed on global warming, caused by greenhouse gases making the planet hotter.

07 People drink glaciers

In dry parts of the world, such as in areas of China and India, people get drinking and farming water from streams and rivers coming from melting glaciers. In fact, about 70% of the world's suitable drinking water is frozen in glaciers.

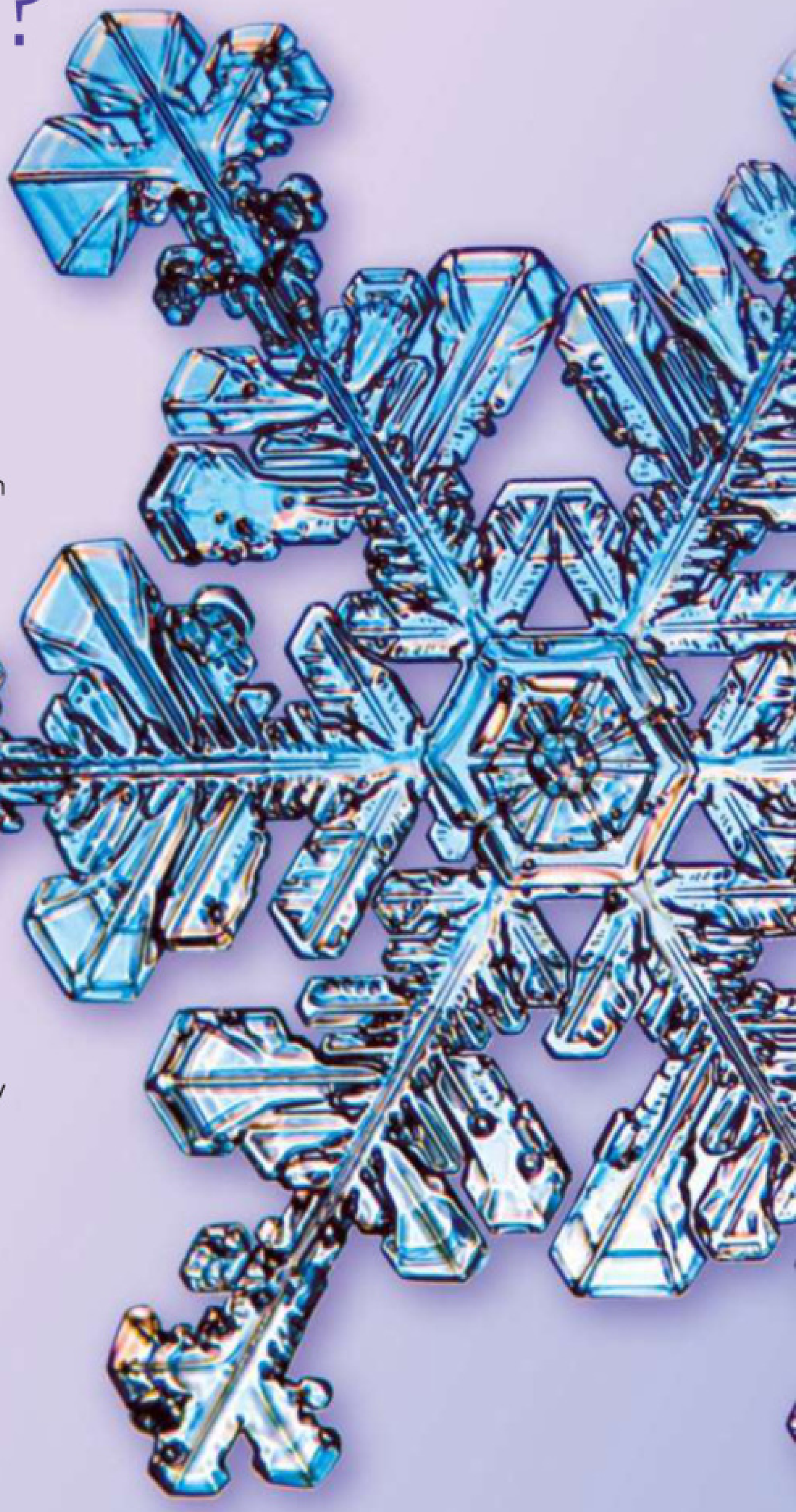
08 The biggest glacier is longer than England

The world's largest glacier is the Lambert glacier in Antarctica, near the South Pole. It is 400 kilometres long, which is even longer than England.

Are all **snowflakes different**?

No one will ever be able to check **every snowflake** in the world, but we still know each one is pretty **unique**!

Snowflakes come in many different shapes and sizes. There are so many, in fact, that we can be pretty sure each one is unique and unlike every other snowflake falling from the sky.



Snowflakes are made up of tiny things called ice crystals. These ice crystals are made from frozen water, and inside every drop of water there are tiny things called atoms and molecules. When these molecules freeze and form crystals, they can line up in lots of different shapes. When you have a snowflake made from a huge number of these crystals, there are so many possible combinations for their shape that we can be sure that no two snowflakes in the world are the same!

The biggest snowflakes ever seen were almost 10cm across!

Snowflakes that have six sides instead of arms are called hexagonal snowflakes.

Six sides

Because the ice crystals that make up snowflakes have six sides, most snowflakes will also have six sides.

What are all snowflakes made of?

Email us with your answer

See page 9

Not all snowflakes are symmetrical. Most have uneven sides, like this one.

Almost perfect symmetry

Most snowflakes look symmetrical, with every side appearing the same as the other sides. You have to use a very powerful microscope to see that they are not perfectly symmetrical.

Can you **start** an **avalanche** by **shouting**?

You can't actually start an avalanche by shouting. To do that, you would need to be **louder than any human in history**!

An earthquake caused the biggest avalanche in history

In 1970, a big earthquake in Peru caused a very wide avalanche down the side of the mountain Huascaran. Sadly, it took 20,000 lives with it.

Avalanches can reach 130km/h in only five seconds! Imagine a block of snow hurtling down a mountain faster than a car driving on a motorway...

An avalanche happens when a lot of snow or ice starts sliding down a steep hill or mountain. It's one of the most impressive and dangerous events in nature! These avalanches can occur as a result of many things, but definitely not because of shouting.

Most often, avalanches happen after a huge amount of snowfall, especially if it has fallen on top of packed snow or slippery ice. As the snow gets warmer and wetter, it can become looser and start sliding downhill. It becomes bigger and bigger as it collects more and more snow on the way down.

A burst of noise creates a wave of air pressure, but noise never causes avalanches. Most avalanches need ten times as much pressure as a jet engine noise creates. You can safely sing at the top of your lungs on your next ski holiday!

There's probably one happening right now

No one knows how many avalanches occur, but in Canada alone thousands happen every year. Countless more happen in mountains across the world. Fortunately, most of them don't hurt anyone.

300km/h

At full speed, an avalanche can travel as fast as a Formula 1 racing car!

You can survive an avalanche by swimming

If you ever find yourself in an avalanche, you can stop yourself from sinking by letting the flow take you and swimming along with it. Moving makes sure the snow doesn't pack around you.

Snowboards can cause avalanches

Because snowboards, skis and snowmobiles cut through the snow, going sideways across a snow-heavy slope can trigger an avalanche.

Where is the **hottest place** on **Earth**?

On some summer days we might feel like we're in the **hottest place** on **Earth**. But in fact this is **Death Valley** in California, **USA**

The hottest temperature ever recorded on Earth was in Death Valley, California. Here it reached a scorching 56.7°C. That is hot enough to melt the tarmac on roads! This temperature was recorded back in 1913, but the average temperature in summer here is still nearly 38°C.

Death Valley gets super hot because of how low it is. Some parts are under sea level, so there is no wind to cool it down. The narrowness of the valley also keeps the air trapped so it keeps getting hotter, just like when we cook food in an oven.

Death Valley is not only the hottest place in North America, it's also the driest!

The ground gets hot enough to cook an egg!

In 2013 a park keeper filmed herself frying an egg in a saucepan she had left out in the super-hot sunshine in Death Valley. Yum!

It hardly gets any rain at all

Death Valley is one of the driest places on Earth. Less than six centimetres of rain falls every year.

Some crazy creatures live here!

Death Valley is home to bats, rats and vultures. There are even tortoises that can go for over a year without drinking!

Average

You will need to take lots of readings over time to find the typical value

It went through the hottest summer ever

Back in 2001, there were 154 days in a row when the temperature was above 38°C. Phew!

It isn't scorching hot all the time

Even the hottest place on Earth can get chilly! In winter, temperatures can reach 0°C, which is the freezing point of water.

What's the **largest desert** in the world?

The **Antarctic polar desert** is the **largest desert** in the **world**, despite being almost completely frozen and covered in **ice and snow**

5 million

This is how many square kilometres the Antarctic polar desert covers

When we think of deserts, we often think of miles of sand and sweltering heat. In reality, the largest deserts on Earth are found in the very coldest areas. This is because a desert is simply a place where there is very little rainfall or snowfall.

Antarctica is located at the most southern tip of the world, right at the South Pole. It is home to the biggest desert on the planet. This is almost completely covered in ice and snow, but very little snow actually falls here. We call these places polar deserts.

The Sahara is the largest hot desert in the world and stretches out across nearly a quarter of Africa. It is made up of sand, rock and even mountains and can reach scorching temperatures of 58°C.

Sahara: the largest hot desert on Earth

Continent: ***Africa***

This huge desert stretches all the way across Africa. It is Earth's hottest desert, but at night temperatures can drop below freezing!

How **tall** is the **tallest sand dune**?

Dunes are **hills of sand** made by wind or flowing water. Some of them grow to half a kilometre high – that's **taller than a skyscraper**!

Sand dunes come in different shapes and sizes. They need three things to form. First, there needs to be lots of loose sand, like at a beach or in the desert. Enough wind needs to blow in order to move the grains of sand. Finally, the sand will require something to block its path.

If sand is blown around by the wind, it will keep moving until an object like a stone gets in its way. This creates a small ramp of sand next to the object. As more sand is blown past the tiny dune, it grows bigger and bigger. Stronger winds create taller dunes, which is why they get so big in windy deserts.

The Badain Jaran sand dunes in China are the tallest in the world. They have reached 500 metres in height

20 metres
That's how far some sand dunes are moving every year in the Gobi desert

Shapeshifter
Dunes are always changing as sand grains are blown from place to place. Some even move across deserts!

The Empire State Building in New York is over 440 metres tall. It's still shorter than the biggest sand dune

Singing dunes
Some sand dunes make mysterious whistling noises when it's windy. Scientists aren't sure about exactly how or why this happens.

Where does **sand** come from?

Sand is formed when **large stones** and **shells** get bashed around and **broken up** by the **sea**. This takes thousands or even **millions of years**

Beaches are changing all the time. Sand particles get picked up by the wind or washed away by the tides or rain. Sometimes powerful storms can wash lots of sand into the sea or blow it inland. The movement of rock particles from one place to another is called erosion.

Weathering
The breakdown of rock into smaller pieces by ocean waves and weather

Golden sand
Most beaches in the world have light, golden sand. These are mostly made from a type of mineral called quartz.

Black sand
Beaches by volcanos usually have black sand. This is because they contain grains of lava left over from eruptions.

Rocks
These get smashed up into smaller pieces by weathering. Once they are small enough they can be moved by erosion.

Shells
These are the remains of sea creatures called molluscs. They get broken down by weathering and erosion, just like rocks.

Red sand
Some beaches have sand that's a deep-red colour. This is because it comes from rocks containing lots of iron.

Journey down the Amazon

The **Amazon** is the **biggest river** in the world. Its unique environment is home to **thousands** of different **animals**. New species are discovered every week!

The Amazon goes across South America, finishing in Brazil

Giant size

The Amazon rainforest covers an area of over 5 million square kilometres. The UK would fit into it 20 times!

Black caiman
Black caimans are the biggest alligators in the world. Some of them reach over five metres long from nose to tail.

Giant otter
Giant otters live, hunt and play together in large family groups. They make loud barks, screams and growls to communicate.

Manatee
Manatees are also called sea cows. They eat plants and grasses that they find at the edge of the river.

River flow

Every second, 200 million litres of water flows out of the Amazon. That would fill 80 Olympic-sized swimming pools!

Jaguar

Unlike most other big cats, jaguars love being in the water. They hunt deer, fish and will even tackle caimans.

Piranha

These small but ferocious fish have super-sharp teeth and very strong jaws. They have been known to attack humans.

Anaconda

These snakes can swim, so they can hunt their prey in the river. They can grow as long as a bus!

Amazon river dolphin

These pale-pink dolphins are also called boto. They can't see well, so use sound echoes to navigate.

World's widest river

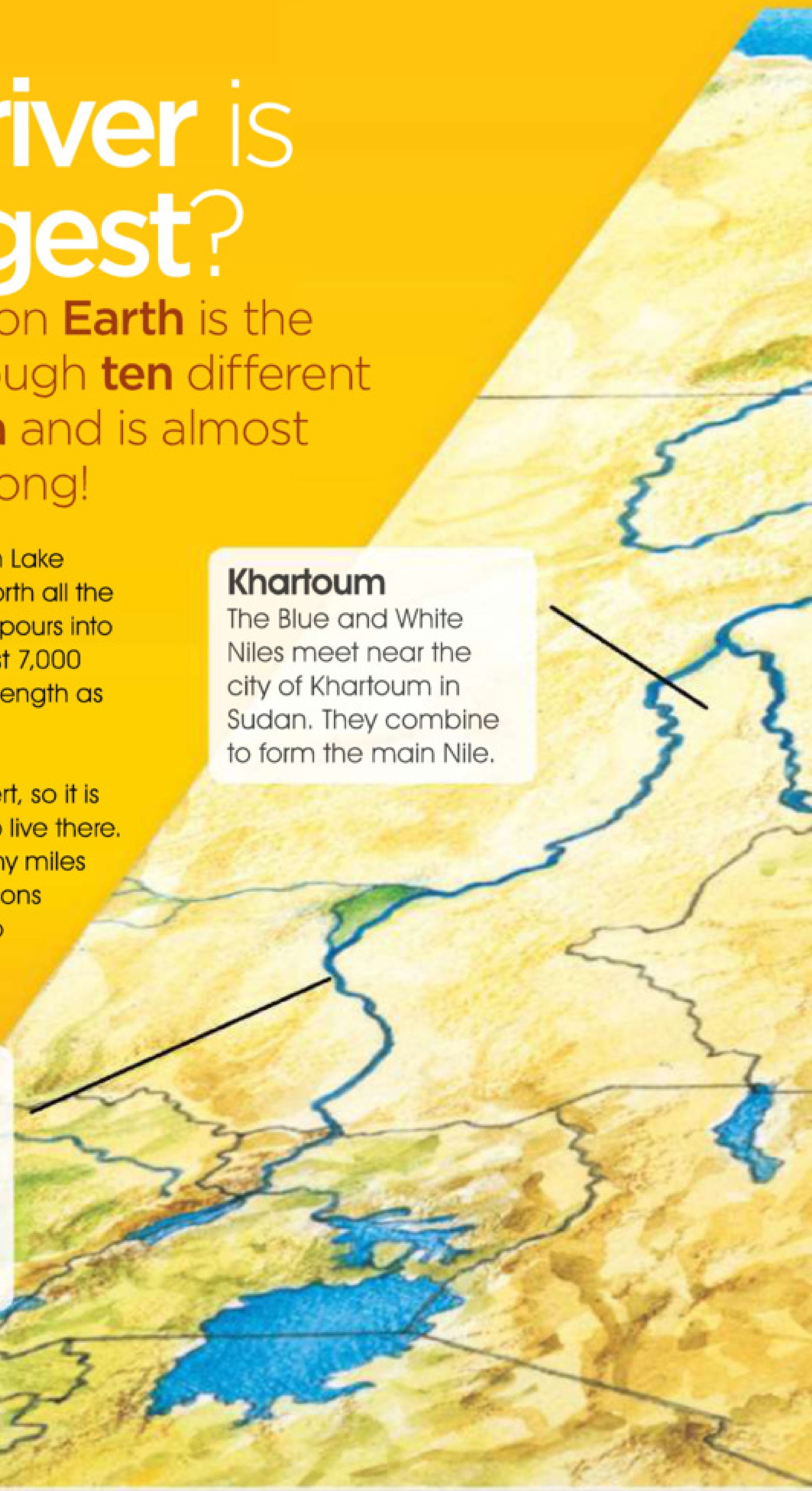
Where it meets the ocean, the Amazon river is 325 kilometres wide – that's almost the distance between London and Paris!

Which **river** is the **longest**?

The **longest river** on **Earth** is the **Nile**. It passes through **ten** different **countries** in **Africa** and is almost 7,000 kilometres long!

The River Nile starts its journey from Lake Victoria in central Africa. It flows north all the way up through to Egypt, where it pours into the Mediterranean Sea. It is almost 7,000 kilometres long – that's the same length as seven Great Britains!

The Nile mostly flows through desert, so it is very important for the people who live there. It is their only water source for many miles around. The Nile is one of the reasons why the Ancient Egyptians were so successful. They used the river to water all their crops.



Khartoum
The Blue and White Niles meet near the city of Khartoum in Sudan. They combine to form the main Nile.

White Nile
This is one of the main sections of the river. Rock particles give the river its white-grey colour.

Blue Nile

One section of the river is the Blue Nile. It starts in Ethiopia and joins with the White Nile in Sudan.

If the Nile were stretched into a straight line it would be almost seven times as long as Great Britain!

The Nile runs from Lake Victoria to the Mediterranean Sea

What's the **world's heaviest** thing?

The **heaviest living thing** on Earth is a **tree.** It's called **General Sherman** and weighs almost as much as 30 **Statues of Liberty!**

The world's biggest tree by volume is called General Sherman. It's also the heaviest living thing on the planet. The tree is named after an American soldier who was admired in his country. The trunk is as wide as the length of a bus, and it's nearly as tall as Big Ben.

General Sherman is a giant sequoia ("seh-koy-yah") tree. This species grows to huge sizes. They are some of the widest and tallest trees on Earth. Sequoias are also some of the oldest living things, reaching 3,500 years old! They weigh so much because their massive trunks hold lots of water.

Big plant power

2 million magazines

General Sherman's trunk contains enough wood to make 2 million copies of this magazine!

500 buses

This huge tree weighs the same as 500 double-decker buses.

1,000 elephants

African elephants are the heaviest land animals, yet this tree weighs as much as 1,000 of them.

Seven shocking plant facts

They may look harmless, but some plants have surprising secrets. These can be disgusting or even deadly!

01 Buttercups are among the deadliest plants on the planet

Buttercups seem pretty innocent, but these little flowers are actually highly poisonous. Buttercups can cause a painful death for any hungry cattle that graze on them, and they can also give humans a nasty rash.

02 Some tropical plants like to eat poo!

Nepenthes rajah has one of the most unusual feeding habits in the world. It makes itself into a toilet for tree shrews and other small animals. It uses sweet-smelling nectar to attract the little animals, then the plant absorbs the droppings and recycles it!

03 The skunk cabbage has a foul stink

Even though some parts of this plant are said to be edible, the skunk cabbage smells nearly as bad as the black-and-white critters that share its name. The plant also contains a chemical called calcium oxalate, which can be deadly if you eat too much!

04 Cacti can survive with little to no water for months on end

05 Nepenthes spathulata eats frogs!

As strange as it may sound, there is a whole family of plants that can trap small creatures such as mice, frogs and shrews. These killer plants use their giant bell-like bodies to contain the creatures, then slowly eats them.

06 The strangler fig murders other plants

As its name suggests, the strangler fig actually grows on trees to steal both their sunlight and the nutrients from their roots. When the poor tree eventually dies, the murderous fig will simply grow onto its next victim.

What yellow flower is poisonous to cattle?

Email us with your answer

See page 9

07 The oleander is the most-poisonous plant in the world

What is a rainforest?

A forest that gets more than **2.5 metres of rain** every year is a rainforest. These are home to **millions** of different **plants and animals**

Rainforests only cover about 6% of the Earth's land surface, but they are incredibly important to the rest of the world. They provide lots of the food and medicines that we use every day and are full of life. Every ten square kilometres of rainforest contains over 1,500 species of flower and 400 species of bird.

There are two different types of rainforest: tropical and temperate. Tropical rainforests are found around the Equator. They are always very warm and wet. Temperate rainforests are found in areas with milder seasons. They are cooler but still very wet. Rainforests are found on every continent except Antarctica.

A zoo

Over half of all animals live in rainforests. Scientists think there are still millions of species left to discover there.

A pharmacy

25% of our medicines contain ingredients that were found in rainforests. Some of these ingredients aren't found anywhere else.

A neighbourhood
Millions of people live in tribes in rainforests. They depend on the environment for shelter, medicine, food and water.

An oxygen factory
Rainforests are home to millions of different plants and trees. They produce lots of oxygen through a process called photosynthesis.

A grocery store
Rainforests produce lots of the different foods we enjoy. Coffee, spices, nuts and cacao (which makes chocolate) all grow there.

Brain Games

The big quiz about Earth and its natural wonders!

Answers on page 127

Pick the right one

01 How many Earths would fit into Jupiter's biggest storm?
Page 34
a. 9
b. 3
c. 4

02 How many hours does it take for Earth to complete one whole spin?
Page 26
a. 14
b. 34
c. 24

03 The force that pulls things towards the Earth is called…
Page 38
a. Magnetism
b. Acceleration
c. Gravity

04 The process when water turns into vapour is called…
Page 78
a. Evaporation
b. Precipitation
c. Condensation

05 How fast can hailstones fall to Earth? *Page 82*
a. 1,000 km/h
b. 160 km/h
c. 50 km/h

06 What's the largest desert in the world? *Page 106*
a. Antarctic polar
b. Kalahari
c. Sahara

Find the match

No two snowflakes are the same, but two of these are! Can you see which ones?

Fill in the blanks Follow the clues to complete the words

01 Can you remember what the deepest part of the ocean is?
Page 72

Ch _ l _ e _ g _ r D _ _ p

02 What is the name of the tallest mountain in the world?
Page 54

M _ u _ a K _ _

03 Big, natural water fountain
Page 74

G _ _ se _

04 What the Earth spins on
Page 25

A _ _ s

05 Who discovered gravity?
Page 38

I _ a _ c N _ _ t _ n

Brain Games

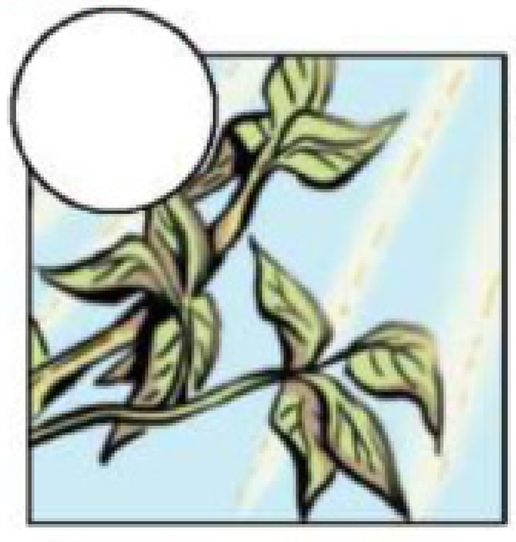
Odd one out

Can you guess which is the odd one out from each row below?

Which of these isn't affected by the Sun?

Temperature

Birds flying

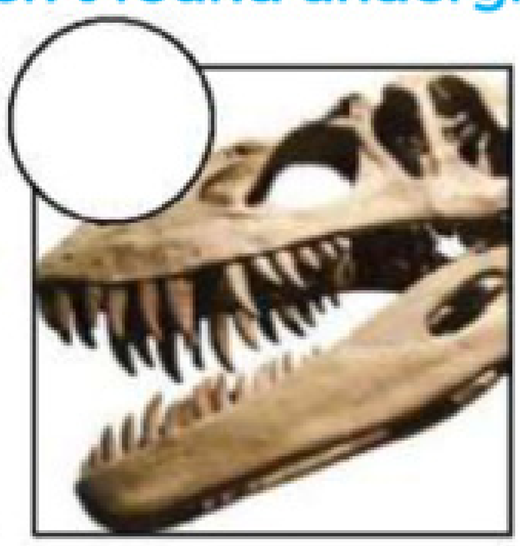


Growing plants

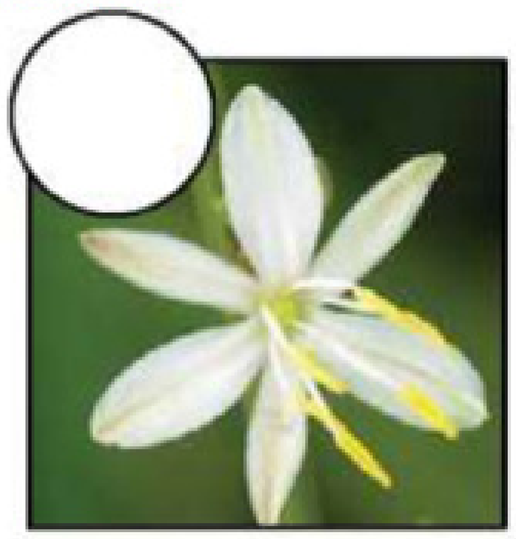
Light to see

Which of these aren't found underground?

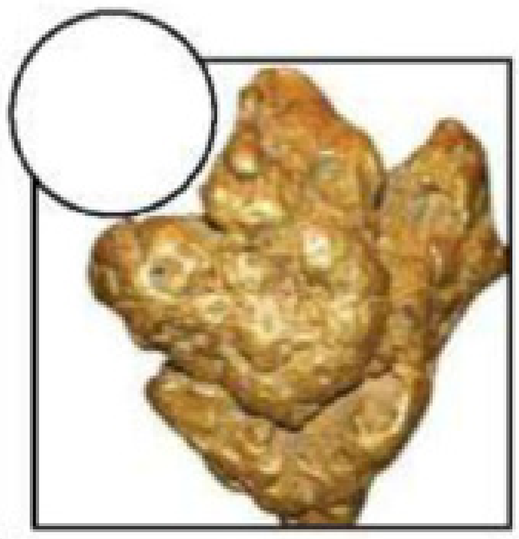
Rubies



Fossils



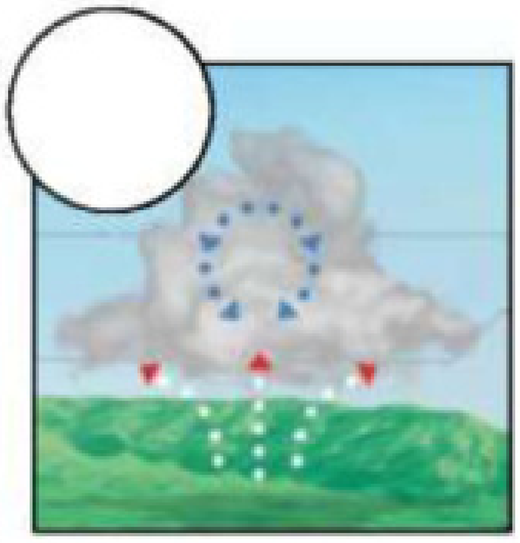
Flowers



Gold

Which of these doesn't contain water?

Iceberg



A cloud

The Amazon

Sand dune

Word hunt

Can you find ten words about our amazing planet hidden in the grid below?

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

Glacier

Earthquake

Tornado

Snowflake

Rainforest

Mountain

Species

Canyon

Desert

Sand

Brain Games

Do you know?

Test what you've learned! All the answers to the questions below can be found in this issue.

01 What's the amazing light show near the North Pole called? *Page 46*

02 What's the name of the imaginary line around the middle of the Earth?
Page 34

03 Name the layer of gas that surrounds the Earth
Page 44

04 How many metres of rain fall in the rainforest each year?
Page 120

05 How many gallons of cola can fit in the Grand Canyon?
Page 92

06 Where can you find most of the frozen fresh water on the planet?
Page 70

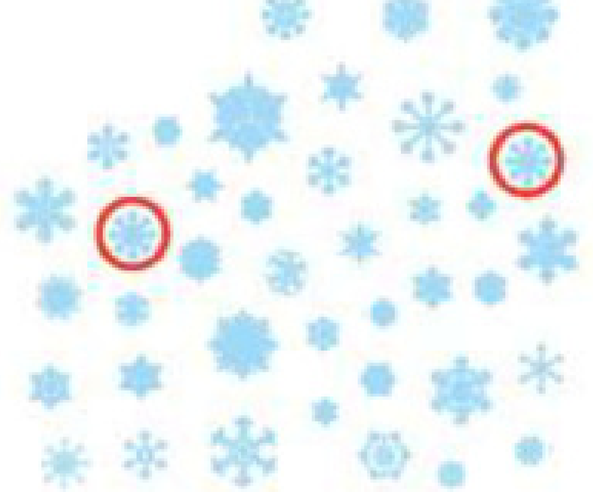
Word hunt

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

Pick the right one

1. b 2. c 3. c 4. a 5. b 6. c

Find the match



Fill in the blanks

1. Challenger Deep
2. Mauna Kea
3. Geyser
4. Axis
5. Isaac Newton

Odd one out

1. Birds flying
2. Flowers
3. Tectonic plates

Do you know...

1. Aurora Borealis
2. Equator
3. Atmosphere
4. 2.5 metres
5. 550 trillion
6. Icecaps and glaciers

Answers

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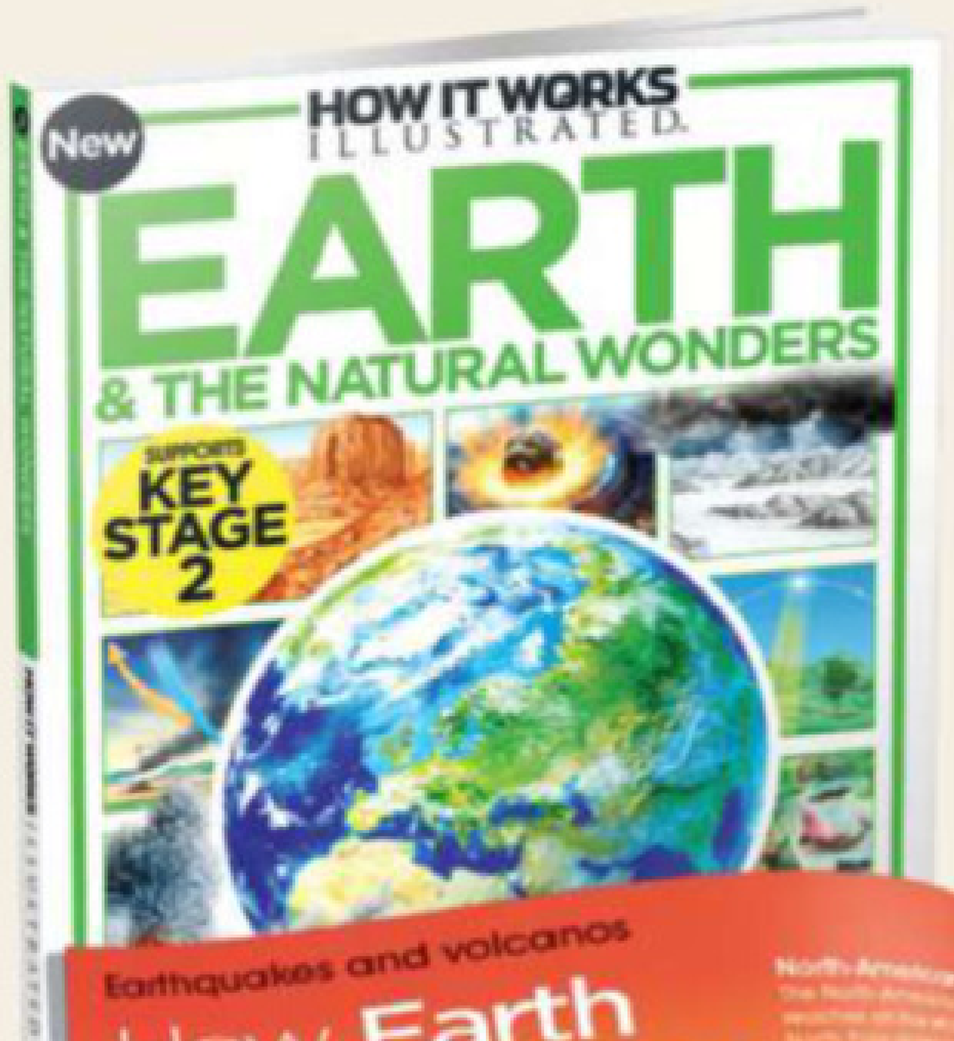

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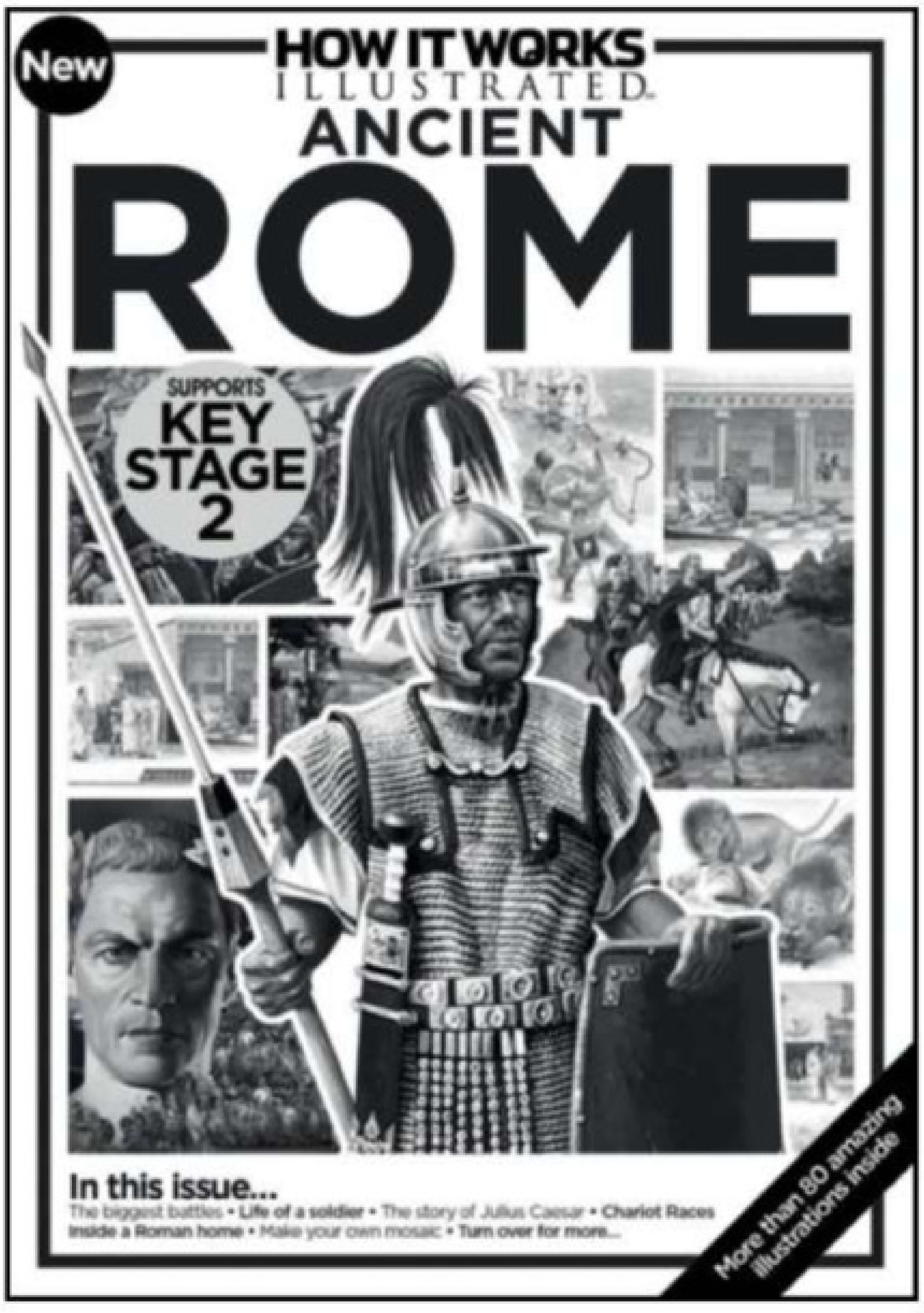

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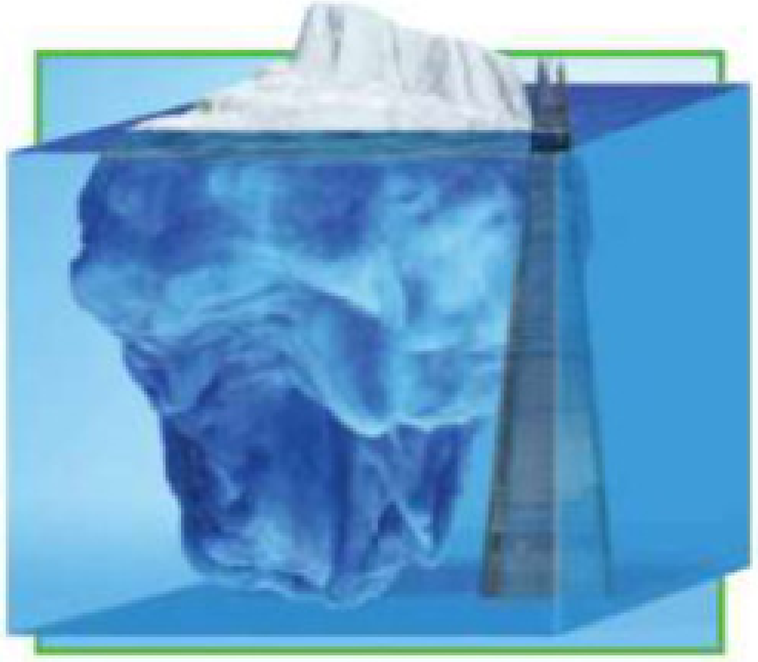

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