

With
4 WIPE-CLEAN
SPOTTING
CARDS



MY FIRST BOOK of WEATHER

Camilla
de la Bedoyere

Cinyee
Chiu

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of
WEATHER



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BIRD HUNT

Can you find the peregrine falcons hiding in this book? There is one in every scene, all except one.

Go to page 63 to find out.

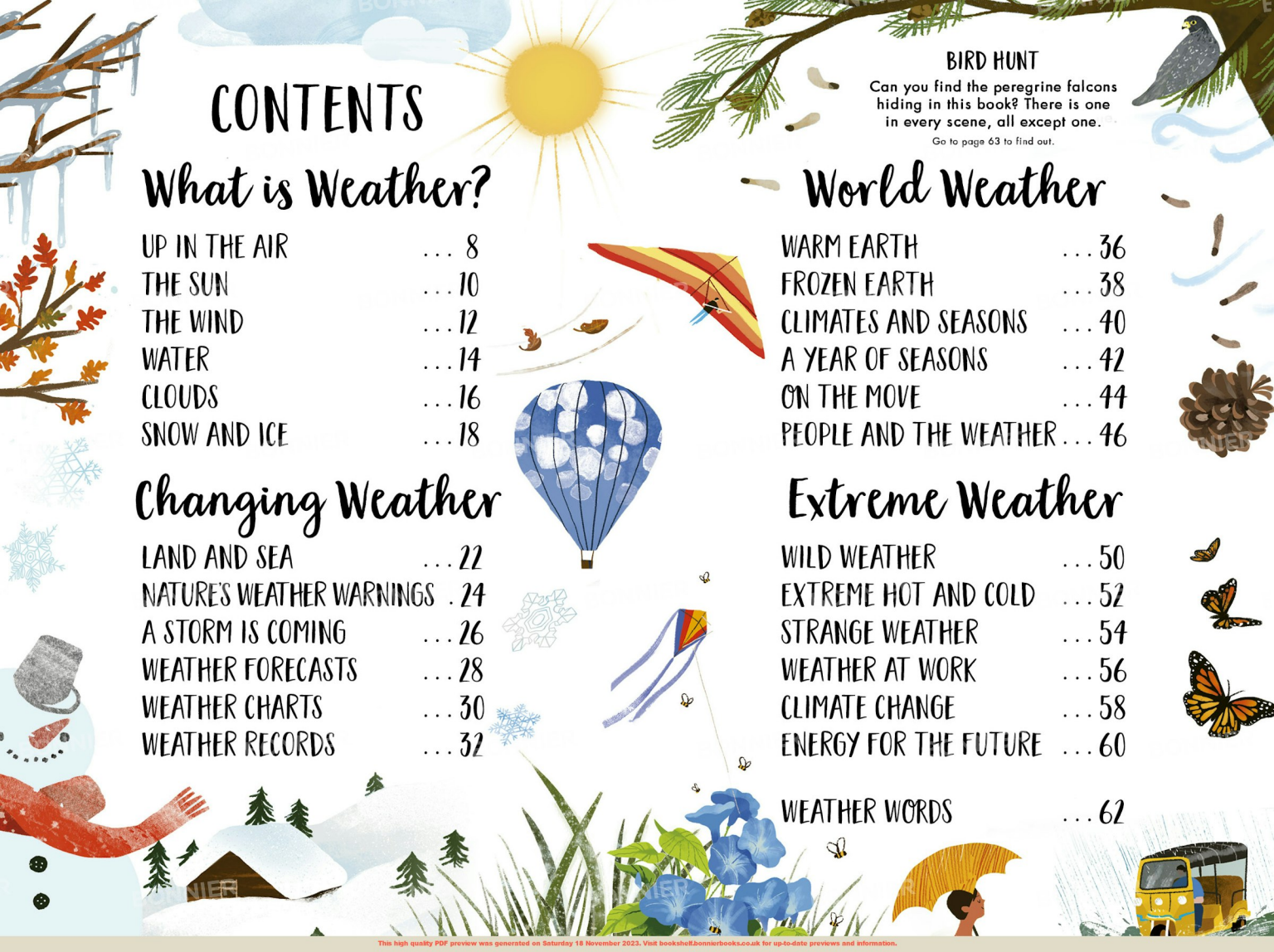
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What is Weather?



Nimbostriatus cloud



Snowflakes



Sunshine

Cirrus clouds

Wind

Icicles

Lightning

Snowman

Frost

Hail

Fog

Rain

UP IN THE AIR

Our planet is wrapped in a blanket of air called the atmosphere. This is where our weather is made. Weather is changing all the time, all over the world.

The atmosphere is made up of air. There are invisible gases in air, such as carbon dioxide, water vapour and oxygen.

The bottom layer of the atmosphere is called the troposphere. The air in this layer is always moving around. It swirls, whirls and flows through the sky, turning the weather warm, wet or windy.

Above the troposphere, the atmosphere slowly thins into space above.

Warm air inside a hot-air balloon lifts it up into the sky

On a fine summer's day, flowers open their petals to take in the Sun's warm rays

Clouds open and drop cooling showers of rain that dampen the ground below

Whistling winds can blow through the trees and meadows, making leaves dance and fly

Wind turbine

Solar panels

Moving air is called wind. The wind blows warm and cold air around the planet and this brings new weather.

The atmosphere makes the world a good place for life. It helps keep our planet just the right temperature – not too hot and not too cold. It is also full of the gases people, animals and plants need to breathe.

THE SUN

The world's weather starts with the Sun. Our sun is a star – a huge ball of glowing gas in space. It gives off energy that bathes our planet in heat and light.

The Sun is very big and very old!

If the Sun were the size of a front door, the Earth would be size of a coin. It is 4.5 billion years old. That number has eight zeroes and looks like this: 4,500,000,000.

The Sun is a long way away. The distance to the Sun is around 400 times the distance to the Moon. Yet we can feel the energy from the Sun as heat and we can see it as sunlight.

The Sun helps our bodies to make vitamin D, which keeps us healthy

1 The Sun rises in the east, marking the start of a new day.

2 A ray of sunlight takes about 8 minutes and 20 seconds to reach the Earth

3 At midday the Sun is high in the sky, right above us, and its rays of energy are at their strongest.

The Sun warms the Earth and the atmosphere traps the Earth's heat close to it. This keeps our planet warm. The warmed air in the atmosphere has energy and that makes it move around, helping to create weather.

The Sun's energy can burn us, so it's a good idea to protect your skin by covering up or using sun lotion.

Plants need sunlight to grow. They use the Sun's energy to make food from water and air. Many animals eat plants, and so the Sun's energy is passed on to other living things on Earth.

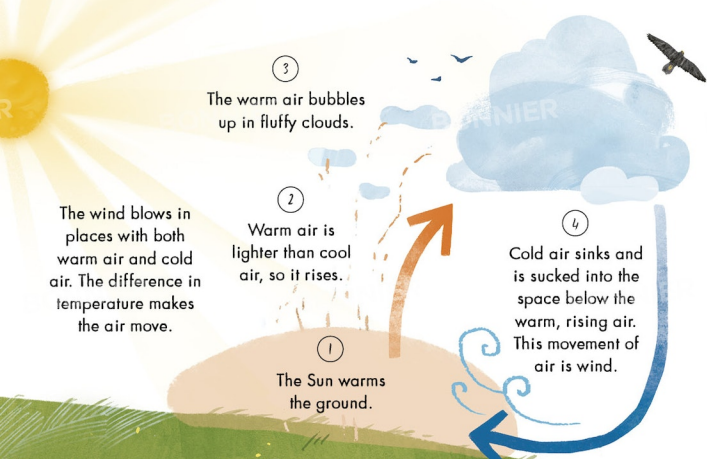
4 In the evening, the Sun sinks below the horizon in the west.

Sunlight is made up of different colours of light. As sunlight passes through the air, the blue light is scattered more than the other colours. That's why we see the sky as blue.

Blue light

THE WIND

Wind is air that is moving from one place to another. Powerful winds blow all over the world. Even though we cannot see the wind, we can see how it moves things and we can feel it on our skin.



A gentle breeze makes leaves flutter but when strong winds blow, trees can fall over. The speed of the wind can be measured on a scale from 0 (no wind) to 12 (hurricane). It's called the Beaufort Scale. Here are some of the levels:

2 LIGHT BREEZE

Grasses and flowers on long stems sway a little in the wind. Leaves rustle.

3 GENTLE BREEZE

Leaves and small twigs on trees are moving constantly.

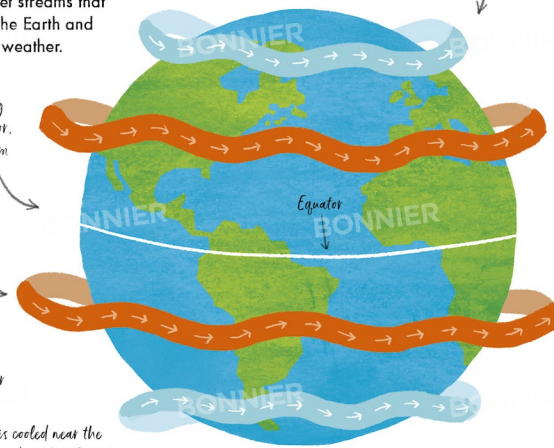
Some winds blow right around the world. Jet streams are strong winds that flow high up in the atmosphere, from west to east. There are four jet streams that blow around the Earth and affect the weather.

Polar jet streams flow in the northern hemisphere and the southern hemisphere

The Sun is strong around the equator, so the air is warm

Subtropical jet streams flow above and below the equator

The air is cooled near the north and south poles



4 MODERATE BREEZE
Clothes on a washing line flap in the breeze.



5 FRESH BREEZE
Colourful kites dart and dive. The moving air makes them dance in the sky.



6 STRONG BREEZE
It is difficult to hold an umbrella when strong breezes blow. Even large branches in the trees sway!

As the wind whips across the top of the ocean, it makes waves. When the frothy tops of the waves tumble, they are said to look like white horses galloping.

WATER

We can't always see it, but water is all around us. Water is always on the move between the air, the land and the sea. The way that water moves around the planet is called the water cycle.

①

When the Sun heats water, it turns into water vapour (an invisible gas). Plants make water vapour, too. They soak up water from the ground and water vapour escapes from their leaves into the atmosphere.

Water vapour from the ocean rises in the air

Water vapour from plants rises in the air

②

High up, water vapour cools to form tiny water droplets. This is called condensation. These droplets gather together to form clouds.

③

Clouds grow bigger as more and more water vapour condenses into tiny droplets. Moving air high up in the sky blow clouds to different places.

④

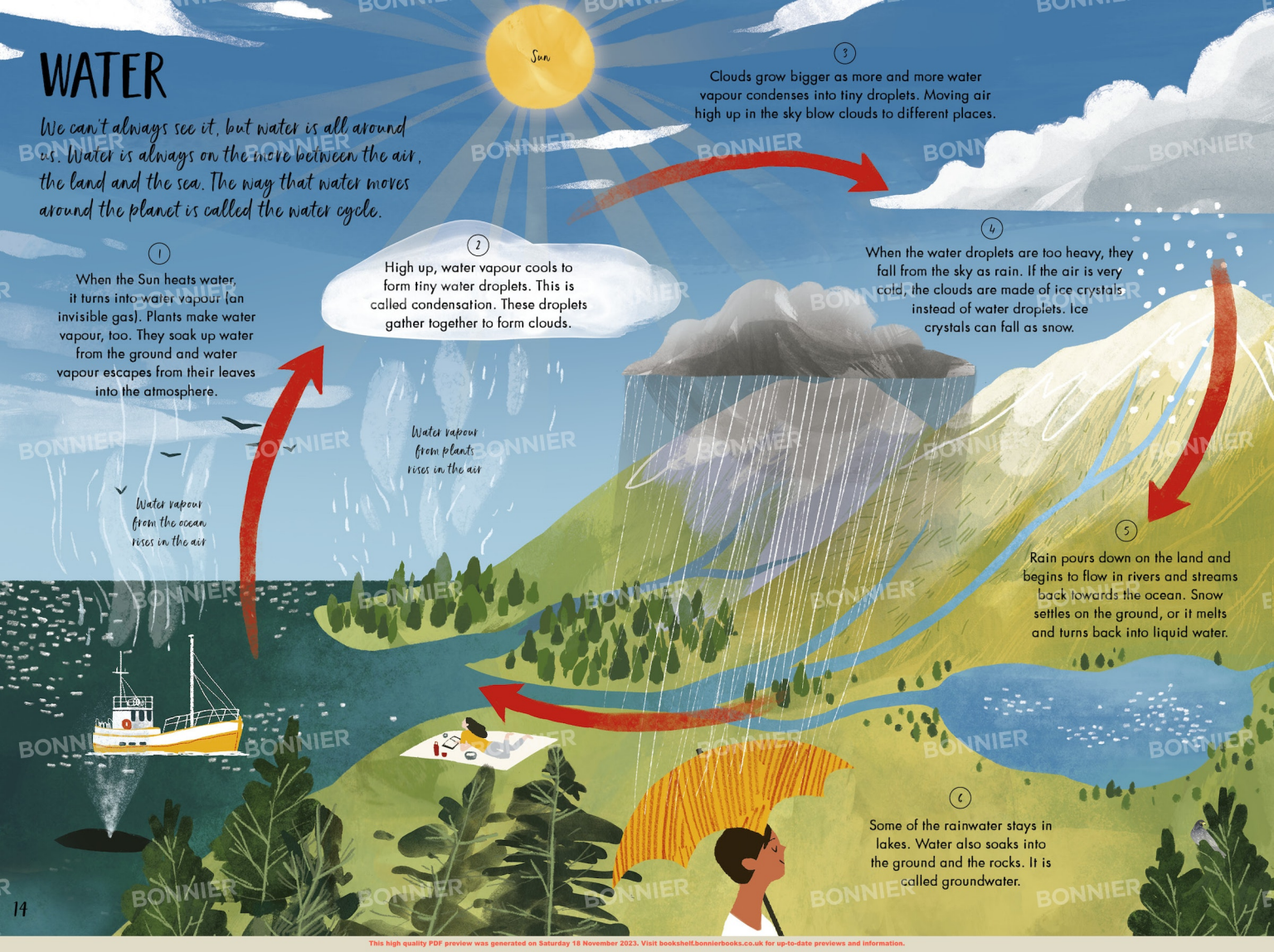
When the water droplets are too heavy, they fall from the sky as rain. If the air is very cold, the clouds are made of ice crystals instead of water droplets. Ice crystals can fall as snow.

⑤

Rain pours down on the land and begins to flow in rivers and streams back towards the ocean. Snow settles on the ground, or it melts and turns back into liquid water.

⑥

Some of the rainwater stays in lakes. Water also soaks into the ground and the rocks. It is called groundwater.



CLOUDS

Clouds sail across the sky, like ships in a sea. As they move, clouds grow bigger or shrink. They can also change their shape and colour.

Clouds are not just rain-makers. Their size, shape and colour can tell us about the weather that is on its way.

There are three main types of cloud: Puffy clouds are called cumulus clouds.

Clouds that grow in long, flat layers are called stratus clouds. Wispy, feathery clouds are called cirrus clouds.

Cumulonimbus cloud

CUMULUS CLOUDS

Cumulus (kyoo-myoo-lus) clouds are fluffy and puffy. They often appear in a blue sky on a warm, sunny day. If they grow, they can turn into towering thunderclouds called cumulonimbus (kyoo-myoo-lo-nim-bus) clouds.

A cumulus cloud grows upwards in puffs and is sometimes called a cauliflower cloud

Stratus cloud

STRATUS CLOUDS

Stratus clouds stretch across the sky, like a grey blanket. They grow low in the sky and the weather is called 'overcast'.

CIRRUS CLOUDS

Cirrus clouds form high up in the sky where it is so cold that the water vapour freezes into tiny crystals of ice. Cirrus clouds are often seen in a blue sky, but they can show that rain or snow is on its way.

Cirrus clouds

Mares' tails

MARES' TAILS

When strong winds blow through a cirrus cloud, they can shape the ice crystals into long, icy streaks that are called mares' tails.

Mackerel sky

ALTOCUMULUS CLOUDS

A sky that is dotted with high, white clouds that look like fish scales is called a mackerel sky. The clouds are altocumulus clouds and this pattern means that a change in the weather is coming.

Clouds appear when there is enough water vapour in the air and the air cools to make a cloud.

Clouds disappear when they warm up. The droplets of water inside a cloud turn back into invisible water vapour.

Nimbostratus cloud

NIMBOSTRATUS CLOUDS

Nimbostratus clouds are so dark they can block out the sunlight. They can bring heavy rainfall that goes on for hours, or even a snowstorm.

SNOW AND ICE

Brrr! It's getting chilly and water is turning to ice. Fluffy flakes of snow slowly fall from low, grey skies and ice crystals sparkle.

Frozen water can fall as snowflakes. It can also fall as hard lumps of ice called hail. If the ice melts slightly as it falls, it forms a mixture of ice and rain called sleet.

Snowflakes are clusters of ice crystals. Every ice crystal has six sides, or arms, and a different pattern to all of the others. Snowflakes form in the atmosphere when ice crystals grow bigger or clump together. Once they are heavy enough to fall, the flakes begin their journey to the ground.

A snowstorm is called a blizzard. Sometimes so much snow falls that it is difficult to see much further than your fingertips! This is called a white-out.

When snow melts, it turns back into liquid water and drips from surfaces such as trees, cliffs or roofs. If those drips freeze again, they make icicles that hang down like pointed teeth.

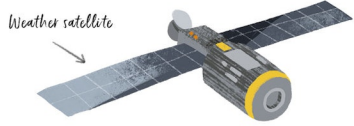
Water on the ground and in ponds freezes into sheets of slippery ice.

A thin blanket of ice crystals may cover the ground and plants. This is called frost, and it often appears after a chilly cloudless night. Frost crystals grow from water vapour in the air, just like snow crystals, but they form on the ground or other surfaces instead of in clouds.

Snow can collect in thick layers called snowdrifts, especially around buildings.

Frost turns cobwebs into sparkly spirals.





Weather satellite



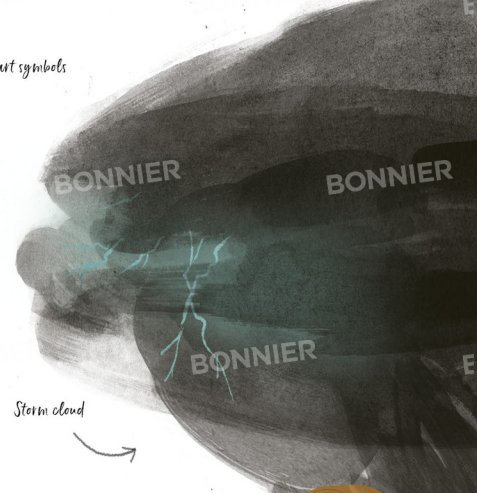
Swallows



Weather chart symbols



Windssock



Storm cloud

Changing Weather



Scanned



Weather balloon



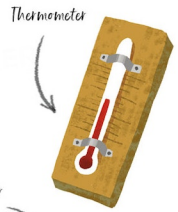
Thermal



Meteorologist



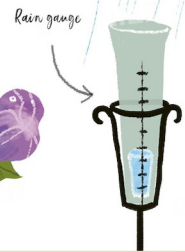
Barometer



Thermometer



Morning Glory flowers



Rain gauge



Weather vane



Anemometer

Rough sea



LAND AND SEA

Land and sea affect the weather. Follow this falcon on her journey as she soars and swoops all the way from a mountain to seaside cliffs. She will see different types of weather along the way.

A spiral of rising warm air is called a thermal

Tall mountains make warm winds rise higher

The climate on a mountaintop can be harsh. Strong winds howl and sweep across the peak, which is cloaked in cold clouds and mist. Some mountaintops are covered in snow all year. This reflects the Sun and can be very bright.

The falcon joins the thermal and lets the warm, swirling air carry her up high. It's much easier to fly this way.

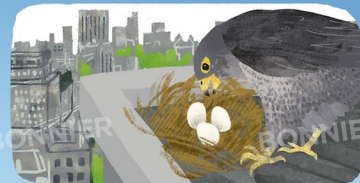
The climate in a town is often hotter than the green spaces around it, especially at night. On a sunny day, buildings warm up and stay hot for longer than fields, parks or woodlands.

Pollution is dirty air that comes from vehicles, factories and fires

It rains more by the sea. Warm, wet winds blow across the water and onto land. They bring showers and fog.

Sea breezes blow onto land during the day. At night, a land breeze blows onto the sea.

The falcon has reached a cliff by the sea. This is where her mate is waiting for her – he has been taking care of the chicks in the nest.



NATURE'S WEATHER WARNINGS

Look closely at nature and you can see signs that the weather may be about to change. Even tiny differences in the air and temperature can affect how animals and plants behave.



PINE CONES DEPEND ON THE WEATHER TO CARRY THEIR SEEDS

There are tiny seeds inside a pine cone. They need the wind to lift them out of the pine cone and carry them to a place where they can grow into new trees.

On a damp day, a pine cone stays closed to keep the seeds safe and dry.

On a dry day, a pine cone will open and the wind will carry the seeds away.



RED SKY AT NIGHT, SHEPHERD'S DELIGHT. RED SKY IN THE MORNING, SHEPHERD'S WARNING

This old saying is true in some parts of the world. It means that if there is a red evening sky, the weather will probably be fine the next day, but if the morning sky is red then storms may be coming.



Crickets chirrup by rubbing their legs against their wings

CRICKETS CHIRRUP ON A HOT DAY

Crickets 'chirrup' to talk to each other. When the insects are warm, their chirrups are faster and louder. On a hot, steamy day their noisy songs warn that a thunderstorm may be on its way.

WHEN SWALLOWS FLY HIGH, THE WEATHER IS DRY

Swallows often fly high on a warm, dry day. They are chasing the flying insects that have been swept up by warm currents of air.



Swallows swoop and dive to pluck insects from the air



SEAWEED SWELLS WHEN IT IS WET BUT IT SHRIVELS UP IN FINE, DRY WEATHER

Seaweed lives in the sea, especially at the coast. People who live by the sea sometimes hang it outside the house and use it to predict the weather.

Morning Glory with open flowers



SOME FLOWERS PROTECT THEMSELVES FROM RAIN BY CLOSING THEIR PETALS

Scarlet pimpernels and morning glory plants open their flowers up to the Sun and buzzing bees on fine, warm days. They close their flowers when the weather is turning wet.

Morning Glory with closed flowers



A STORM IS COMING

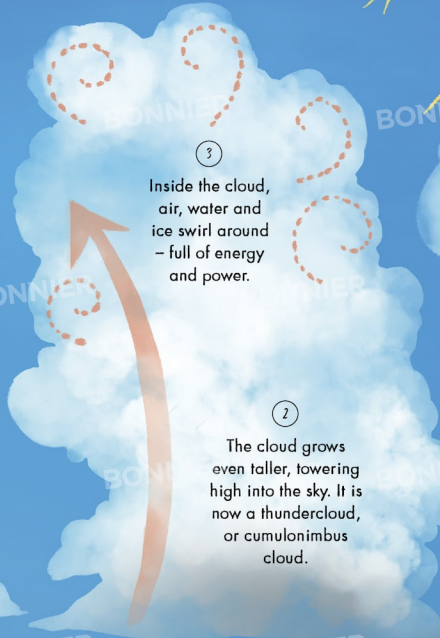
Thunderclouds grow tall and turn dark when they are full of water and ready to burst. Soon, there will be flashes of lightning zipping through the sky and loud rumbles of thunder.

After a long spell of hot weather, small cumulus clouds join together and begin to grow into one, bigger cloud. A storm is on the way...



①

The hot ground heats the air above it. The hot air rises into the cloud.



②

Inside the cloud, air, water and ice swirl around – full of energy and power.

②

The cloud grows even taller, towering high into the sky. It is now a thundercloud, or cumulonimbus cloud.

The bottom of the cumulonimbus cloud is dark and flat

The top of a cumulonimbus cloud can be 12 kilometres high – that's 39 times taller than the Eiffel Tower!



As the air rises, the water vapour condenses into cloud droplets

Warm upward flows of air are called updraughts

Lightning zigsags between the cloud and the ground

④

THIS THUNDERCLOUD IS ABOUT TO BURST!

Droplets of water in the cloud grow bigger. When they get too heavy, they begin to fall as rain. Sometimes, heavy ice crystals grow and fall as hailstones.

⑤

As ice crystals rub against each other, they make electricity. A bolt of lightning zips through the sky.



As air cools, it falls downwards in a downdraught

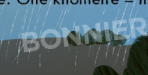
③

Lightning is much hotter than the surface of the Sun! The heat makes the air expand and this creates a mighty noise called thunder.

The light from lightning travels much faster than the sound of thunder. You can work out how far away a storm is by counting how many seconds pass between the flash and the rumble. One kilometre = three seconds.

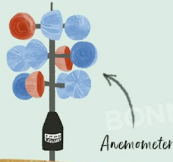
⑦

The heavy rainfall cools the ground and stops it from warming the air above. The cloud will soon disappear.



WEATHER FORECASTS

We can measure the weather. Keeping a record of the hours of sunlight, the amount of rain and the direction of wind helps us work out how the weather is changing. This is called weather forecasting.



A wind gauge is called an anemometer. It measures the speed of the wind. A weather vane shows the direction the wind is blowing.

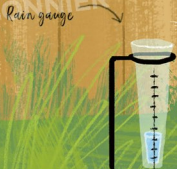


A barometer is used to measure the air pressure, which is the force of air pressing down on the ground. Air pressure is useful in working out how the weather will change.



A thermometer measures temperature. We use it to find out how hot the air is. As the air gets hotter, the temperature rises.

A rain gauge is a simple way to record how much rain has fallen. We can keep records over a long time to see how rainfall changes over a year or over many years.



Over time, the temperature and rainfall can be recorded on a graph.



Weather measurements are called observations. Many observations can be made by weather balloons and satellites in space.



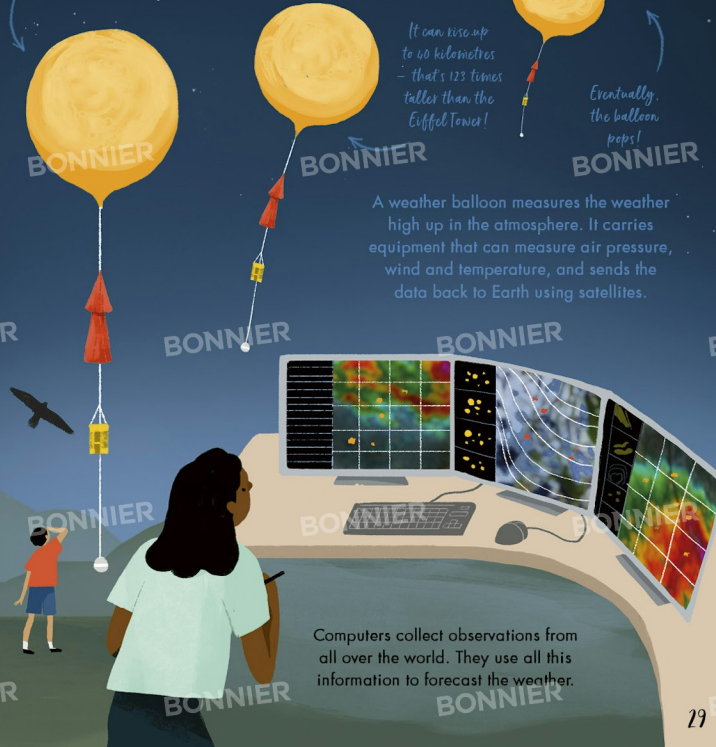
Weather satellites travel in space above the atmosphere. They can take photographs of clouds and weather events such as storms.

These space machines can measure the temperature of ocean water and even watch weather moving in the clouds.

A weather balloon is filled with a gas that makes it float upwards.

It can rise up to 60 kilometres – that's 123 times taller than the Eiffel Tower!

Eventually the balloon pops!



A weather balloon measures the weather high up in the atmosphere. It carries equipment that can measure air pressure, wind and temperature, and sends the data back to Earth using satellites.

Computers collect observations from all over the world. They use all this information to forecast the weather.

WEATHER CHARTS

Weather maps, or charts, show what the weather is now, or what it will be in the days or weeks ahead. The first weather charts were drawn by hand. Today, computers are used instead.

Once weather and climate data have been collected they can be used to make a chart like this one. Symbols are used for different types of weather, such as rain and wind.

FRONTS

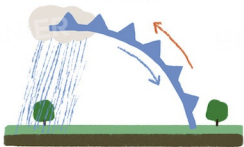
The wind moves large masses of air around the world. The places where different air masses meet are called fronts and they bring a change in weather.

WARM FRONT



A warm front happens where a mass of warm air is pushing slowly into a mass of cooler air. It may cause rain clouds to form.

COLD FRONT



A cold front happens when cold air quickly pushes warm air up and away. Cold fronts make storm clouds and rain.

SYMBOLS

A weather chart uses signs and symbols on a map to show what type of weather is expected in different places.

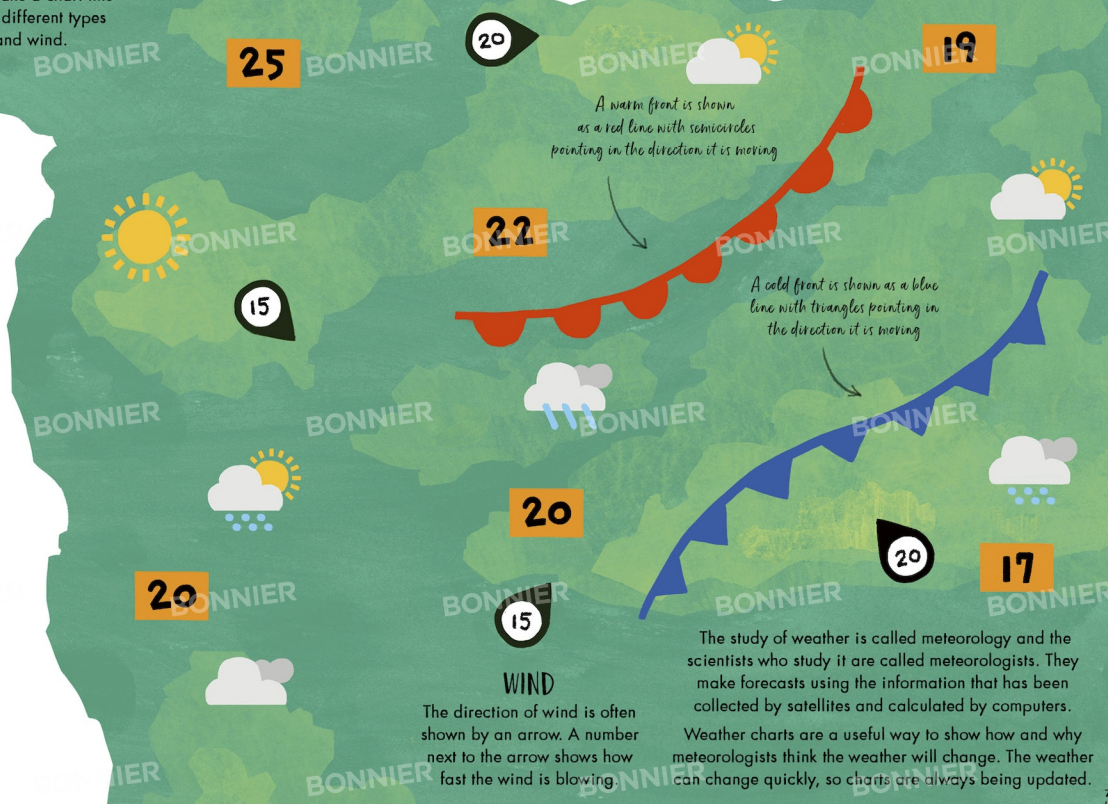


TEMPERATURE

The temperature is shown as a number. If the number is blue then the temperature is freezing. This means it is below 0 degrees Celsius.

5

-2



A warm front is shown as a red line with semicircles pointing in the direction it is moving

A cold front is shown as a blue line with triangles pointing in the direction it is moving

WIND

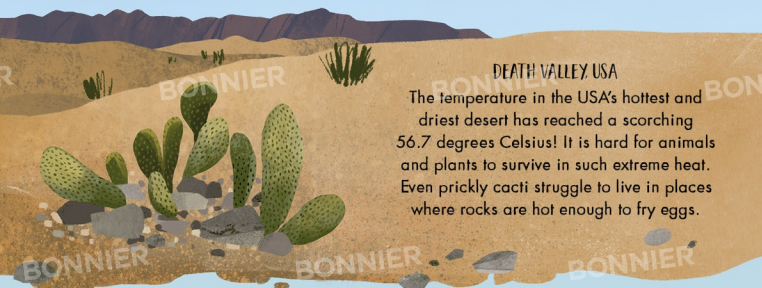
The direction of wind is often shown by an arrow. A number next to the arrow shows how fast the wind is blowing.

The study of weather is called meteorology and the scientists who study it are called meteorologists. They make forecasts using the information that has been collected by satellites and calculated by computers.

Weather charts are a useful way to show how and why meteorologists think the weather will change. The weather can change quickly, so charts are always being updated.

WEATHER RECORDS

Extreme weather and more unusual weather events have set world records. These events are rare, but as our climate changes many of these records are likely to be broken.



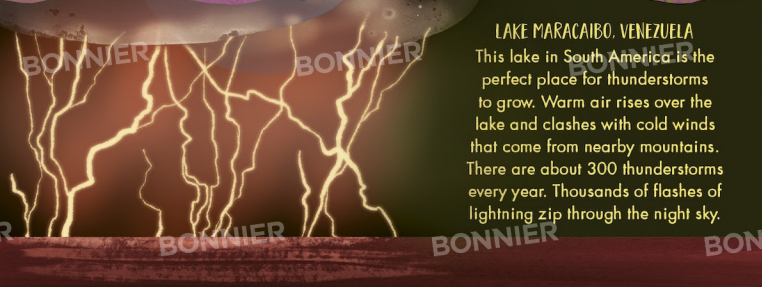
DEATH VALLEY, USA

The temperature in the USA's hottest and driest desert has reached a scorching 56.7 degrees Celsius! It is hard for animals and plants to survive in such extreme heat. Even prickly cacti struggle to live in places where rocks are hot enough to fry eggs.



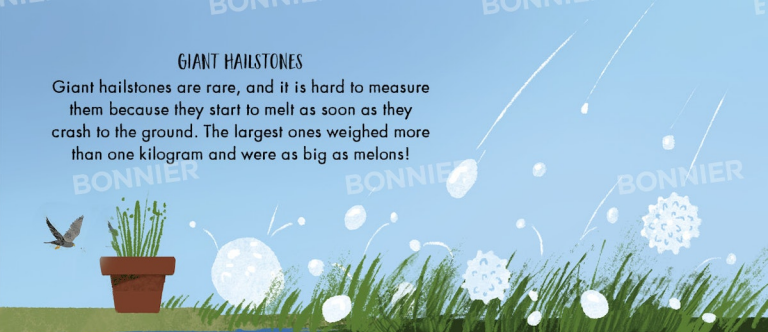
ATACAMA DESERT, CHILE

Parts of the Atacama Desert can go for years without a drop of rain. That makes it the driest place on Earth. When it does rain, pink flowers sprout to life and cover the ground.



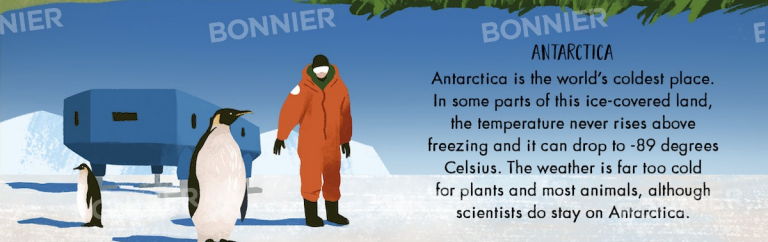
LAKE MARACAIBO, VENEZUELA

This lake in South America is the perfect place for thunderstorms to grow. Warm air rises over the lake and clashes with cold winds that come from nearby mountains. There are about 300 thunderstorms every year. Thousands of flashes of lightning zip through the night sky.



GIANT HAILSTONES

Giant hailstones are rare, and it is hard to measure them because they start to melt as soon as they crash to the ground. The largest ones weighed more than one kilogram and were as big as melons!



ANTARCTICA

Antarctica is the world's coldest place. In some parts of this ice-covered land, the temperature never rises above freezing and it can drop to -89 degrees Celsius. The weather is far too cold for plants and most animals, although scientists do stay on Antarctica.



WASHINGTON STATE, USA

The mountains here are some of the world's snowiest places. In just one winter, nearly 30 metres of snow fell. That's enough to bury a tall building!

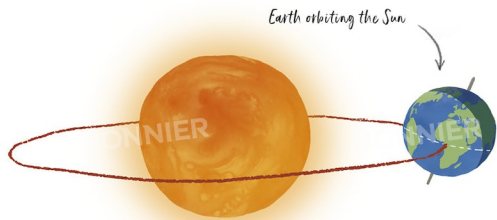


MAWSYNRAM AND SOHRA, INDIA

The people who live in these two towns in Northeast India are used to rain. More than 10 metres can fall in a year, and in the year of 1861 around 26 metres of rain fell in Sohra.



Putting on sun location



Earth orbiting the Sun

World Weather



Skier



Monarch butterflies



Desert



Antarctica



Hang-glider

Arctic terns

Winter tree

Autumn tree

Summer tree

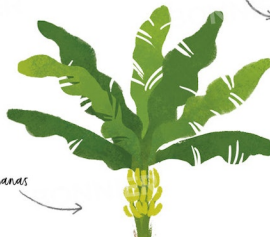
Fox cub

Spring tree



Farmer in temperate regions

Farmer in tropical region



Bananas



WARM EARTH

In the past, the Earth's climate has often been much warmer than it is today, with no ice anywhere.

Earth explodes with life during hotter periods. In a hot, wet climate, lots of plants grow and that means there is plenty of food for animals. During a warm period, there are more animals and plants than during a cold period.

Flying reptiles called pterosaurs flapped their wings or glided on the warm winds

This is how the Earth looked during the Late Jurassic, which lasted from 163 million to 145 million years ago. It was part of a long, warm period. There were vast forests with conifer trees and huge ferns, but no flowers. Dinosaurs roamed the land, flying reptiles called pterosaurs swooped in the sky, and big swimming reptiles grew more than 6 metres long.

Plesiosaurs looked quite like crocodiles, but they had flippers instead of feet

Cycads grew before dinosaurs were alive, and they still live in warm places today

Trees grew tall in the warm climate, but long-necked dinosaurs like *Diplodocus* could still reach their leaves. This mighty dinosaur measured more than 30 metres from its nose to the tip of its tail.

Seed
Diplodocus

Stegosaurus

Allosaurus was a large, meat-eating dinosaur

Most plants today grow their seeds in flowers and fruits, but in the Jurassic period, few plants grew this way. Most plants needed the wind to carry their pollen to other plants. The wind also carried their seeds to new places where they could grow.

The first birds, such as *Archaeopteryx*, looked like feathery, flying dinosaurs

The dinosaurs and pterosaurs died out 66 million years ago. This is believed to have happened because a huge asteroid hit the Earth. Dust blocked out sunlight and the weather turned cold. Plants died and many other animals became extinct.

FROZEN EARTH

In the past, the Earth's climate has sometimes been much colder than it is today, with large sheets of ice across the top and bottom of the planet.

When large parts of the Earth are covered in ice and snow, it is called an ice age. During the last ice age, ice covered most of North America, Northern Europe and Asia. In warmer places there was very little rain, so deserts formed there.

Big animals were suited to the extreme cold. Woolly mammoths and woolly rhinos had bulky bodies, fur and a thick layer of fat to keep them warm. These animals could go without food for a long time.

Plants need warmth, water and sunlight to survive. During the long periods of cold weather, water froze and huge areas of ground were covered in snow. Fewer plants means less food for animals.

Woolly mammoths

Woolly rhinos

A cave lion's white fur helped it to hide in the snow while it hunted

Woolly mammoth calf

Megaloceros - one of the largest deer that has ever lived - had antlers that grew to more than 3 metres wide



THE LAST ICE AGE
The last ice age began about 2.5 million years ago. Ice covered large areas.



TODAY
We are in a warmer period of the last ice age. The Earth still has ice caps.



SNOWBALL EARTH
If the whole planet becomes totally covered in ice, it is known as Snowball Earth.

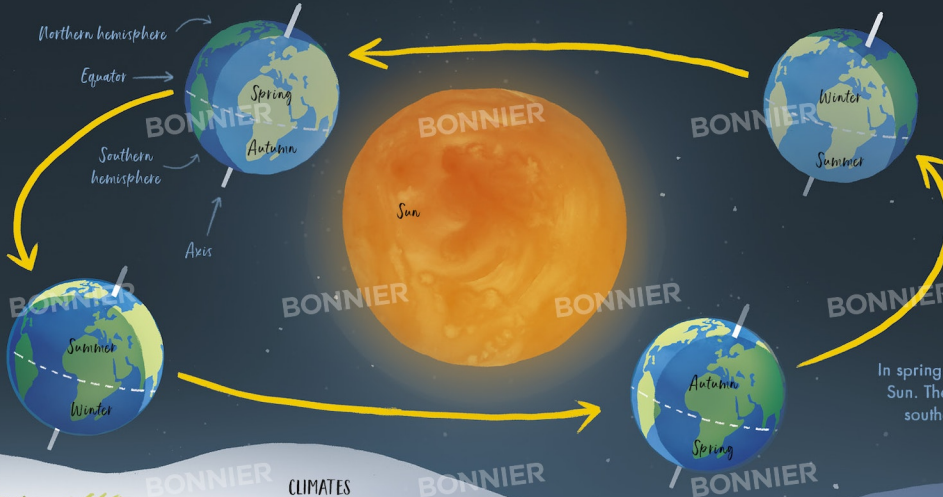


CLIMATES AND SEASONS

The Earth is a planet in space and it circles around the Sun once a year. This giant journey affects the world's weather through the year and in different parts of the world.

1 The Earth spins around the Sun. Its journey is called an orbit. The Earth's axis is tilted and this is what gives us seasons.

2 When the northern hemisphere is tilted towards the Sun, it gets more sunlight and the days are longer. It is summer here.



4 When the northern hemisphere is tilted away from the Sun, it gets less sunlight and the days are shorter. It's winter here.

When it is winter in the northern hemisphere, it is summer in the southern hemisphere.

3 In spring and autumn the equator faces the Sun. The days are the same length in the southern and northern hemispheres.

CLIMATES

Climates are patterns of weather that a place experiences over a long period of time

The areas between the tropics and the polar regions have a temperate climate. The weather here is mild weather most of the time and there are four seasons: spring, summer, autumn and winter.

Areas around the equator are called the tropics. They have a tropical climate, which is hot with plenty of sunshine. Some tropical areas also have wet and dry seasons.

The polar regions don't get strong sunshine because of the tilt of the Earth. The polar climate is cold and there are just two seasons: winter and summer. In winter, it is dark even in the daytime, because the Sun doesn't rise above the horizon.

In the polar summer, it is light even in the night-time

A YEAR OF SEASONS

From spring showers to snowy winters, the weather in temperate woodlands changes with the seasons. The animals and plants change with them.



Trees burst into leaf and blossom

Birds are busy building nests and laying eggs

Fruits, seeds and berries grow and ripen

Chicks have grown big enough to fly the nest

SPRING

The days get longer and the weather grows warmer. There is plenty of rain and the wind can be strong and chilly.

Many baby animals are born

Insects buzz around, sipping nectar or collecting pollen

Frogs and toads gather on ponds to lay their eggs

Frogs and newts hide from the hot sun, but snakes and lizards bask

Insects, such as bees and wasps, look for a dry, safe place to spend the winter

Some birds and butterflies fly to warmer places for the winter

Trees with bare branches rest until the spring when they will burst into life again

Many trees prepare to survive the winter chill by losing their leaves

AUTUMN

The nights grow long and there is less sunshine to warm the woodland. The weather starts to turn rainy, foggy or windy.

Mushrooms like cool, damp weather and sprout up around tree trunks

Animals such as squirrels store food for the winter

Some animals find snug places to keep warm where they wait for better weather

WINTER

The days are short, so the weather turns cold and the skies are often grey and gloomy. Snow, ice and frost make everything sparkle.

Hungry creatures find the stores of food they hid in autumn

ON THE MOVE

Some animals go on long journeys to avoid winter weather. They set off for places where they can find food or the perfect place to breed.

Arctic terns soar across entire oceans to enjoy a year of endless summers. They are record-breaking travellers, flying up to 70,000 kilometres in a year.



JULY TO AUGUST

The terns leave their breeding grounds in Greenland, near the Arctic, before gales cover the land in snow. They fly south across the Atlantic Ocean.



NOVEMBER

After four months, the terns reach the sea around Antarctica. They find plenty of fish to eat before heading north again in April.



MAY TO JUNE

The terns arrive back in Greenland where they lay their eggs. They raise their chicks in the northern hemisphere's summer.



Monarch butterflies migrate in their millions each year to avoid the deadly winter chill.

JULY TO AUGUST

In Canada and Northern USA, the butterflies feed, mate and lay their eggs. Butterflies that emerge from chrysalises in early autumn will soon migrate.

No one is sure how these insects find their way to forests in Mexico and California, but they may use the Sun and the Earth's magnetic field.



NOVEMBER TO JANUARY

The butterflies fly south to reach cool mountain forests in California and Mexico. They sleep until spring arrives in February, when they start to fly north.



MAY TO JULY

On their journey, the butterflies stop to lay eggs. Each new generation of adults continues the journey north and reaches Northern USA and Canada in the summer.



The elephants of Mali, West Africa, live on the edge of one of the world's driest places – the Sahara Desert. They survive the heat and droughts by following the rains. Mali elephants make the longest migration of any elephants, walking 600 kilometres in a year.

NOVEMBER TO MAY

In the dry season, the elephants stay in the north of their range. They find water by travelling between lakes. By May there is almost no water left.

JUNE TO AUGUST

The elephants listen for thunder and follow the rain clouds. They walk south where more rain falls at this time of year. Many plants have grown.

AUGUST

The weather turns dry again. It is time for the elephants to begin migrating back to the north on their circular route.



PEOPLE AND THE WEATHER

The weather is part of our daily life. Weather can affect what we do, what we eat, how we travel, what clothes we decide to wear and even how we feel. It can be fun, too!

Light winds and clear skies are the perfect weather conditions for a hot-air balloon



Acoplanes fly faster when there is a strong wind behind them



The wind and atmospheric pressure are useful for flying. Thanks to the weather, there are lots of ways that humans can copy birds, bats and bugs and take to the air.

A parachute allows a person to float safely to the ground



The Sun can burn us, but hats and sun cream protect our skin.



The wind helps boats to travel. It fills their sails and pushes them across the water.



The wind that whips up the water gives surfers and windsurfers a boost as they ride the waves



Cars and buses struggle to drive on snowy roads, but skis slide along easily. Some children who live in cold countries ski to school in winter.

Buses and cars can slip on icy roads, but special snow chains help their tyres to grip on the smooth surface



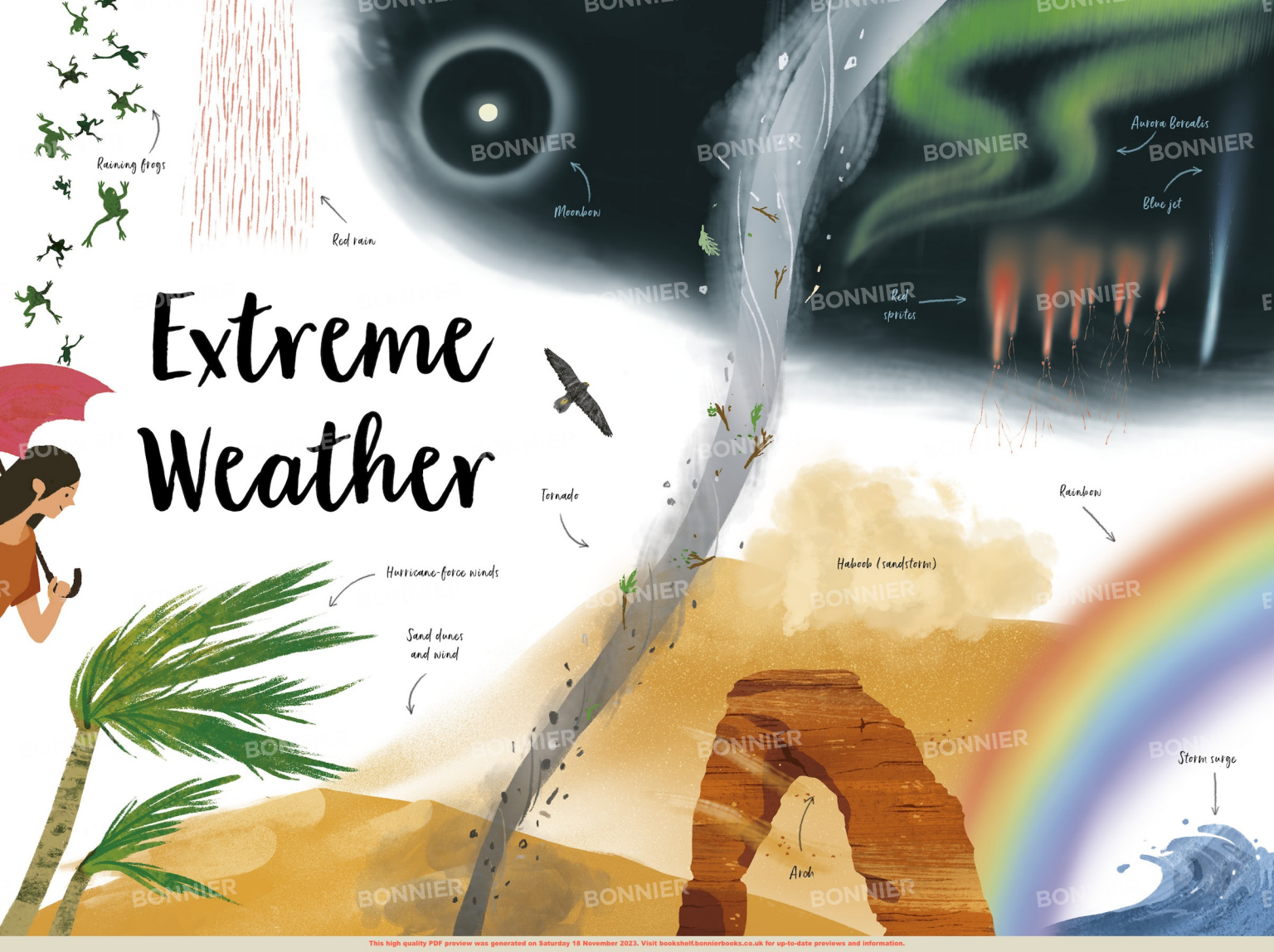
Farmers in temperate places grow different foods for each season. Most food crops, including beans, potatoes and carrots, are harvested in summer and autumn, but some, such as cabbages, can survive the winter.



Farmers in the tropics can pick ripe and juicy fruit from trees all year round. Plants that give us coffee, tea, chocolate, bananas and pineapples only grow in warm places.



Extreme Weather



Raining frogs

Red rain

BONNIER
Moonbow

Moonbow

BONNIER

BONNIER

Aurora Borealis
BONNIER

Blue jet

BONNIER
Red sprites

BONNIER

Tornado

Rainbow

Hurricane-force winds

Haboob (sandstorm)

Sand dunes and wind

BONNIER

BONNIER

BONNIER

BONNIER

Arch
BONNIER

Storm surge

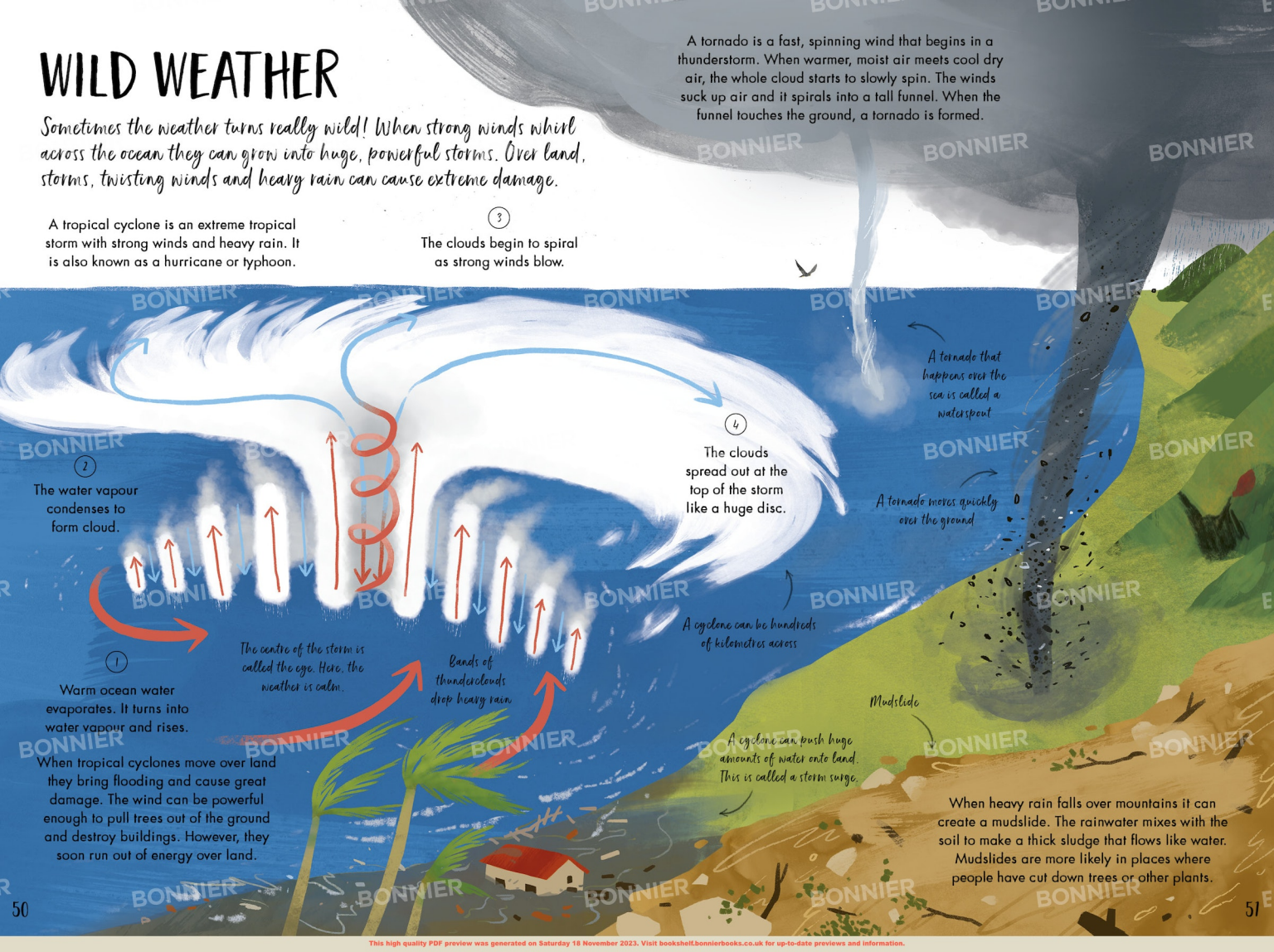
WILD WEATHER

Sometimes the weather turns really wild! When strong winds whirl across the ocean they can grow into huge, powerful storms. Over land, storms, twisting winds and heavy rain can cause extreme damage.

A tropical cyclone is an extreme tropical storm with strong winds and heavy rain. It is also known as a hurricane or typhoon.

③ The clouds begin to spiral as strong winds blow.

A tornado is a fast, spinning wind that begins in a thunderstorm. When warmer, moist air meets cool dry air, the whole cloud starts to slowly spin. The winds suck up air and it spirals into a tall funnel. When the funnel touches the ground, a tornado is formed.



② The water vapour condenses to form cloud.

Warm ocean water evaporates. It turns into water vapour and rises.

When tropical cyclones move over land they bring flooding and cause great damage. The wind can be powerful enough to pull trees out of the ground and destroy buildings. However, they soon run out of energy over land.

The centre of the storm is called the eye. Here, the weather is calm.

Bands of thunderclouds drop heavy rain.

A cyclone can be hundreds of kilometres across

A cyclone can push huge amounts of water onto land. This is called a storm surge.

A tornado that happens over the sea is called a waterspout

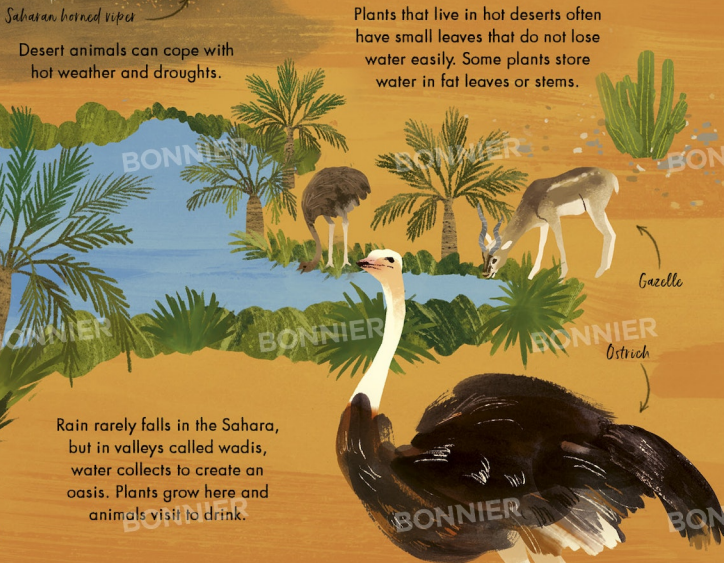
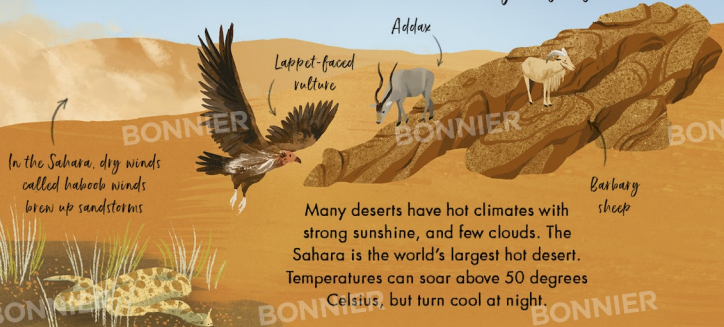
A tornado moves quickly over the ground

Mudslide

When heavy rain falls over mountains it can create a mudslide. The rainwater mixes with the soil to make a thick sludge that flows like water. Mudslides are more likely in places where people have cut down trees or other plants.

EXTREME HOT AND COLD

Deserts are very dry places that have extreme temperatures. These conditions make it difficult for living things to survive, but even in the Sahara and Gobi deserts there are signs of life.



The Gobi Desert in Asia is called a cold desert. During the long winter the temperature can drop to -40 degrees Celsius. The Gobi Desert is so cold and dry that it can experience both sandstorms and snowstorms in one day!

It rarely rains in winter, but snow sometimes blows in from Siberia and lightly frosts the sandy dunes.



STRANGE WEATHER

The world can surprise us with some unusual and wonderful weather. We have all seen a rainbow, but did you know the weather can give us a blue moon, green flashes or red sprites?

A moonbow looks like a halo around the Moon.



Aurora lights

Near the poles, particles from the Sun sometimes hit the atmosphere to create shimmering curtains of light. In the northern hemisphere they are called the northern lights or Aurora Borealis. In the southern hemisphere they are called the Aurora Australis.

If strong moonlight passes through raindrops, a ghostly moonbow can form.

Rainbows appear in the opposite side of the sky to the Sun.

1 Sunlight is white light, but that white light is made up of all the colours of the rainbow.

Sunlight

Water droplets

2 As sunlight hits water droplets in the air, the white light bends and splits into seven colours.

3

The colours always appear in the same order: red, orange, yellow, green, blue, indigo and violet.

Blue jets are sparks of lightning that can only be seen shooting up from the top of a thundercloud.

Red sprites are red lightning flashes that flare up towards space. They appear in groups but they last less than a second.

Blue jet

Red sprites

Blue jets and red sprites are rare types of lightning that are best seen from space. Scientists are trying to work out what causes them.

It's raining frogs!

Tornadoes and waterspouts have winds so strong they can suck up small animals and drop them back to Earth again as they slow down. Some people have reported seeing frogs falling from the sky, but others say they have seen showers of worms, squid or fish!

It's raining red rain! Storm winds can pick up tiny red algal spores – which are seeds from seaweed – and carry them up into rain clouds. When the rain falls, it is red.

WEATHER AT WORK

Over thousands of years, the weather can change the world. Wind, rain and ice turn mountains into towers of balancing boulders and grind stone into sand. This is called weathering.

The weather has created the Shilin Stone Forest in the soft limestone rocks in China

ACID RAIN

Rainwater is not pure water. It is slightly acid. It dissolves a rock called limestone. Over time, the damaged rock can then be shaped by wind and rain into strange pillars.

FROST SHATTERING

Rainwater can seep into the cracks in rocks and freeze there. As water freezes into ice it takes up more space than when it was liquid. Over time this weakens the rock by making the cracks bigger, and small pieces break off.

Frost-shattered rock

WIND EROSION

Wind can whip around rocks, carrying tiny pieces of grit or ice crystals that wear the rocks away. This is called erosion. Sometimes, the rocks end up in amazing shapes such as hoodoos and balancing boulders.

This is a natural arch. The hardest rocks are left standing, but softer rocks have been eroded by the wind.

A hoodoo, or fairy chimney, is a pillar of soft rock with a top stone of harder rock. Hoodoos are common in deserts.

This mushroom rock has been carved by wind. The wind can carry more sand near the ground, so it erodes the lower layers faster.

CARVING CAVES

Acid in rainwater or groundwater dissolves limestone underground, creating caves.

Dripping water can create unusual rock structures, such as stalactites and stalagmites.

Stalactites hang down

Stalagmites grow up

When stalactites and stalagmites meet each other, they create columns.

CLIMATE CHANGE

The world's climate has changed over millions of years, but now humans are changing it too. We are making the world warmer, and that will affect the weather and living things everywhere.

The gases made by factories, boilers and cars are a type of pollution

When we burn fossil fuels they make gases, such as carbon dioxide, which go into the atmosphere.

Carbon dioxide and other gases in the atmosphere stop heat escaping from the Earth's surface into space. The more of these gases there are, the warmer the Earth gets. This changes the weather everywhere.

Heat rises from the warm ground

Carbon dioxide moves from the air into the sea

Trees are cut down so the land can be used for farming or building. Forests help to keep the climate stable, so losing them affects the weather and can even create deserts.

Coal, oil and gas are types of fossil fuels that are found in the ground or under the sea. We burn them to get energy, such as electricity. We use that energy to cook food, heat our houses, travel and make things in factories.

Buildings and roads stop rainwater from seeping slowly into the ground. This can cause floods.

The oceans heat up as well as the air, ice and ground. Warmer oceans can affect the patterns of rainfall and temperature around the world. Some places will get more rain, but others will not get enough.

Coral reefs grow in warm, clear and salty water, but if the water gets too hot, or too polluted, the coral dies

Many ocean animals, including fish, shellfish and turtles, may not be able to survive in warmer oceans

A warmer Earth means the ice around the north pole and south pole is beginning to melt.

ENERGY FOR THE FUTURE

The Sun, wind and rain can be used to make energy that does not pollute the environment. These types of energy are renewable, which means they will not run out. They are good for us and good for the world.

SOLAR POWER

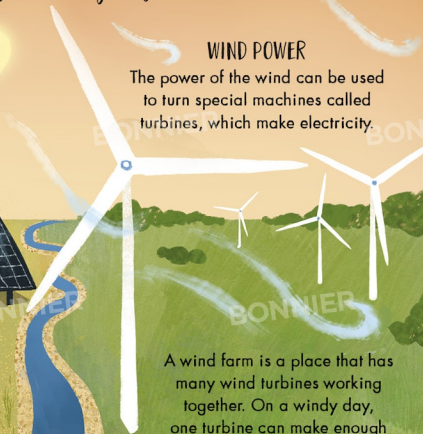
We can use the Sun's energy. It is called solar power.



Solar panels collect the Sun's energy and turn it into electricity. This energy doesn't run out because sunlight is free and there is lots of it! Solar panels work best in places where there is strong sunshine all year.

WIND POWER

The power of the wind can be used to turn special machines called turbines, which make electricity.

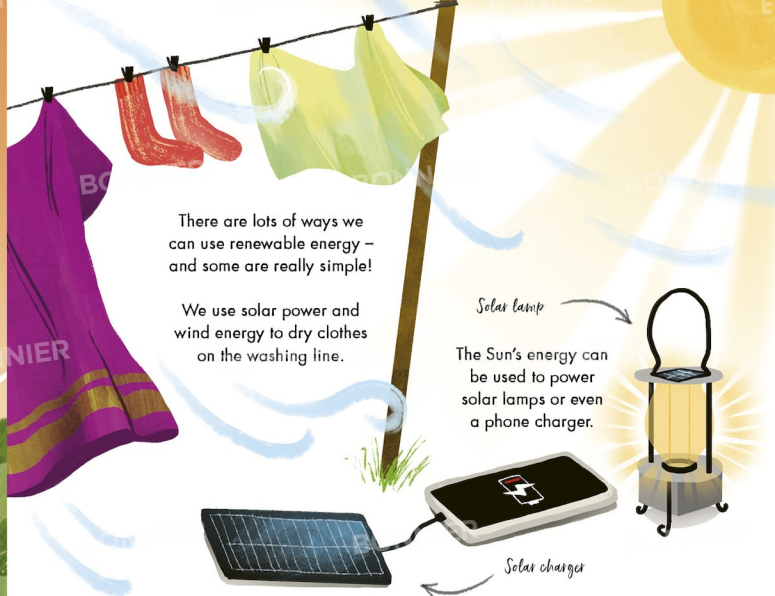
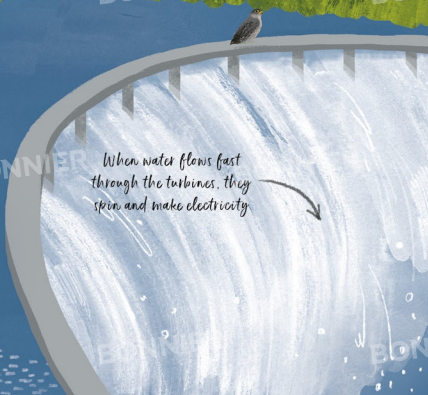


A wind farm is a place that has many wind turbines working together. On a windy day, one turbine can make enough electricity for 500 homes.

HYDROPOWER

Flowing water can be used to make electricity. This is called hydropower. At a hydroelectric power station a high reservoir stores water. The water is held back by a wall, called a dam. The water flows through pipes that lead from the reservoir to the turbines below the dam.

When water flows fast through the turbines, they spin and make electricity.



There are lots of ways we can use renewable energy – and some are really simple!

We use solar power and wind energy to dry clothes on the washing line.

Solar lamp

The Sun's energy can be used to power solar lamps or even a phone charger.

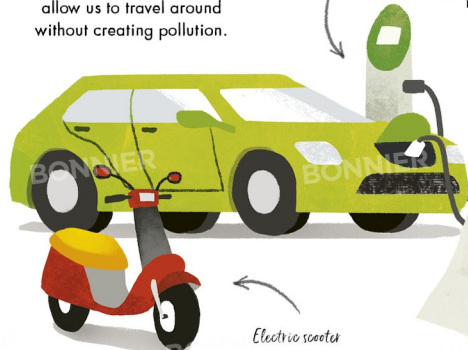


Solar charger

Renewable energy can be used to charge batteries that are used to power electric cars and electric scooters. These vehicles allow us to travel around without creating pollution.

Electric cars can recharge at special stations

Some energy companies offer their customers the chance to buy 'green energy' to power their houses. This energy comes only from renewable sources.



Electric scooter

Welcome to Green Power

100% Renewable Energy

Helping to protect the planet for a cleaner future.

WEATHER WORDS

BIRD HUNT

You won't spot a falcon on pages 36–37. These birds live almost all over the world today, but they were not alive in the Jurassic.

ATMOSPHERE

The layer of gases that surrounds the Earth.

ASTEROID

A piece of rock that falls to Earth from space.

CARBON DIOXIDE

An invisible gas in the atmosphere.

CLIMATE

The pattern of weather that a place experiences over a long time.

CONIFER

A type of tree that grows cones and has needle- or scale-like leaves all year.

DESERT

A place that has very little rainfall all year.

EQUATOR

An invisible line that divides the world into two halves.

EVAPORATE

When liquid water turns into water vapour.

EXTINCT

Animals and plants that go extinct have died and are gone forever.

HAILSTONES

Lumps of ice that form sometimes when rain freezes.

HEMISPHERE

The Earth is divided into two halves by the equator. Each half is called a hemisphere.

ICE AGE

A long period of time when the Earth's climate cooled down and ice caps formed.

ICE CAP

A huge sheet of ice that covers large areas of land, especially in polar places.

METEOROLOGIST

A person who studies weather and climate.

OXYGEN

An invisible gas in the atmosphere. Animals breathe in oxygen.

POLLUTION

Something that is damaging to the environment.

SEASON

A period of time in a year that has distinctly different weather to the other times.

TEMPERATE

A climate that is mild all year – not very hot and not very cold.

TEMPERATURE

A measure of how hot, or cold, something is.

THERMAL

A current of warm air that is moving up.

TROPICAL CYCLONE

A strong storm that forms in the tropics. It is also known as a hurricane.

TROPOSPHERE

The lowest layer of the atmosphere.

WATER VAPOUR

An invisible gas in the atmosphere.

WEATHER

The state of the atmosphere, the temperature and the amount of wind, sunlight, cloud and rain.



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