4th edition

geog.2

geography for key stage 3

< rosemarie gallagher > < richard parish >

OXFORD
UNIVERSITY PRESS

Contents

Key for symbols in 'Your turn' questions

Literacy   Numeracy

1 Using GIS

The big picture

This chapter is about **geographic information systems**, or **GIS**.
GIS is a really exciting way to use maps. Here's the big picture …

◆ A geographic information system consists of a computer with GIS software and a map, and data for the map area.

◆ The software lets you display the data on the map very quickly.

◆ You can bring up different kinds of data together, and look for patterns and connections.

◆ GIS helps people to work quickly and make good decisions.

◆ Learning about GIS is really important, for a good geographer. That's you!

Your goals for this chapter

By the end of this chapter you should be able to answer these questions:

◆ What does *GIS* stand for?

◆ What is *software*?

◆ GIS needs *data*. What is data? What examples can I give? (At least three.)

◆ The data in GIS is shown in *layers*. What does that mean? What example can I give, to explain it?

◆ To make sure data shows up at the right place on a map, it is linked to latitude and longitude. How can I obtain latitude and longitude – for example, of a zebra crossing near school?

◆ What is GIS used for? Give at least five examples.

◆ In what ways is using GIS different from using paper maps?

◆ In what ways is using GIS better than using paper maps?

And then …

When you finish the chapter, come back here and see if you have met your goals!

Did you know?
◆ Most mobile phones can tell you latitude and longitude.
◆ Check it out!

Did you know?
◆ You can phone home from the International Space Station (320 – 435 km above Earth).

Did you know?
◆ In Google Earth, you can explore Mars …
◆ … and Earth's deep oceans.

Why...
◆ … do we humans like collecting data?

Your chapter starter

Look at the photo on page 4. What is the man doing?

He has a map. Why?

He has other information too. What?

What do you think he'll do, if he notices something that bothers him?

Is he affecting people's lives? If yes, in what way?

Did you see my data?

John Snow, doctor and detective

Read about Doctor John Snow, who used a map to help him find the source of a cholera outbreak.

Cholera in London, 1854

On 31 August 1854, a cholera outbreak hit the area called Soho, in London. Within three days 127 people had died. Within ten days, 500 were dead. Many terrified people closed up their homes and fled.

At that time nobody knew what caused cholera, or how to treat it. Some thought you got it by breathing 'bad air' from things that were rotting. (Today we know it is caused by bacteria, and is quite simple to treat.)

Doctor Snow on the case

Doctor John Snow was working in London at the time. He thought cholera was spread by water, not air. So he decided to investigate.

He started with a map of the Soho area, and marked on it all the households where people had died. He also marked the water pumps on. And then he looked for patterns.

He noticed a cluster of deaths around a pump in Broad Street. But many deaths were closer to other pumps. On enquiring, he found that even those people had used the Broad Street pump. Some were children who had passed it on their way to school.

The pump is shut down

Doctor Snow convinced the council that the water from the Broad Street pump was the source of the cholera. So the pump handle was removed. But by then the outbreak was already dying away.

How did the water get infected ?

In those days, most people in London got their water from street pumps. (Only the wealthier had piped water.)

And there was no sewage system like today. Toilet waste fell into a smelly pit under your house, called a **cesspool**. When it was full, you paid people to empty it.

The cholera outbreak had begun with a baby girl in Broad Street. She had been infected from elsewhere. And her mother had dropped the baby's waste, full of cholera bacteria, into the cesspool.

But the cesspool was leaky. So the bacteria made its way into the well under the Broad Street pump.

▲ Cholera. He has had severe diarrhoea and vomiting. He's dehydrated. He will probably die.
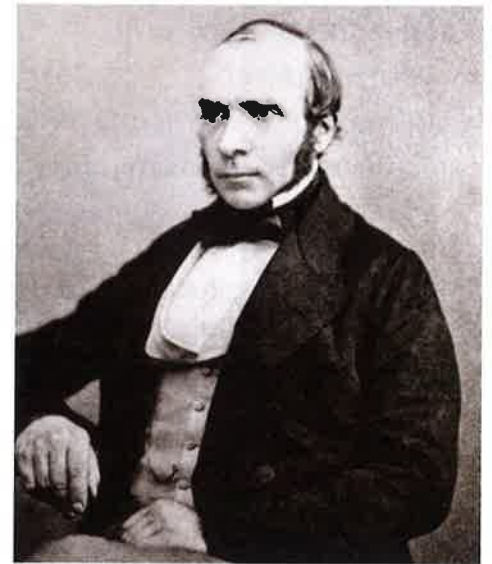
▲ Doctor John Snow.
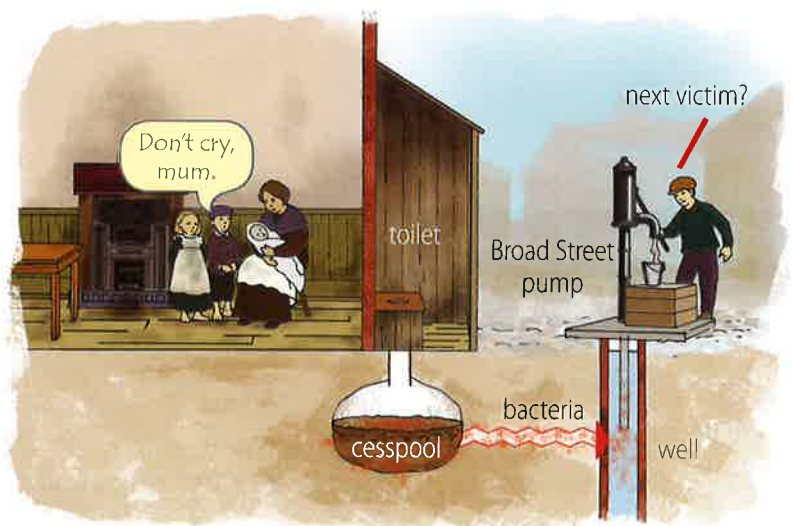
▲ How the water at the Broad Street pump became infected.

Doctor Snow's map
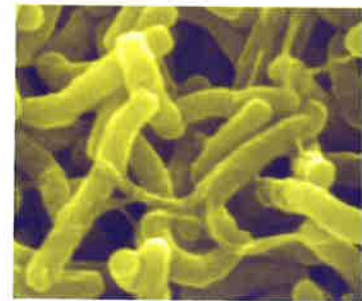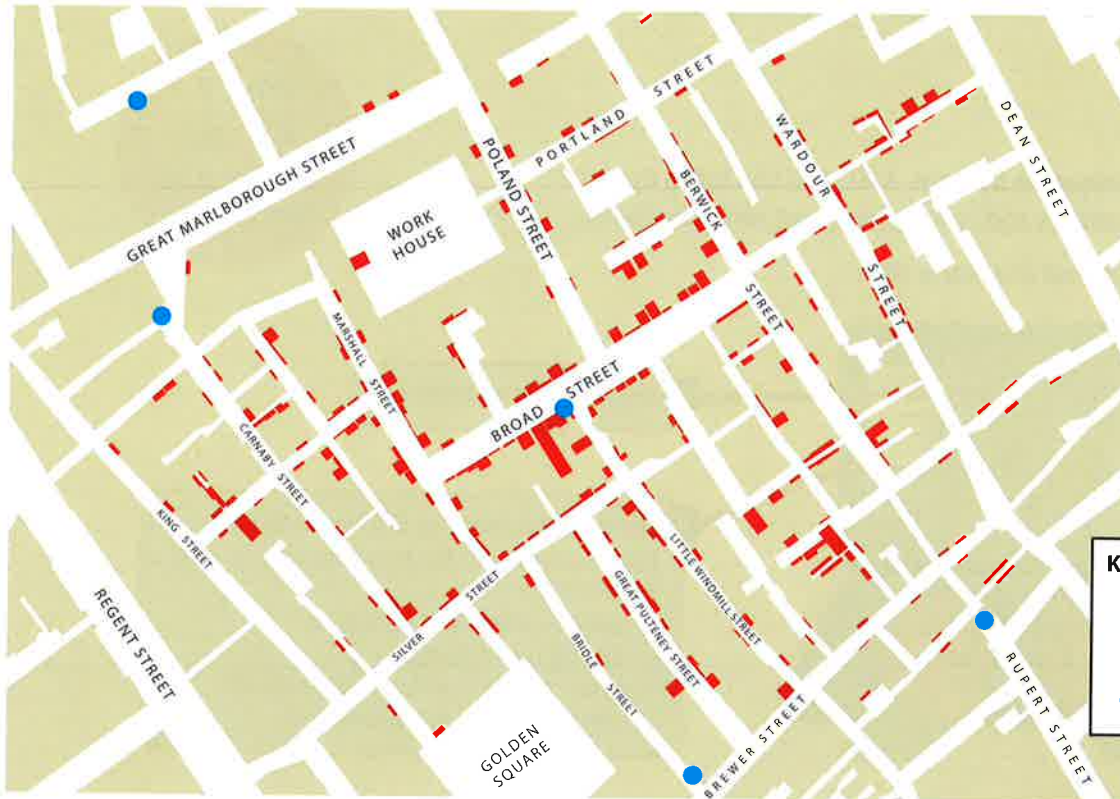
▲ *The cholera bacteria.
In those days, people didn't have
powerful microscopes so could
not see them.*

Key

▌ (red bar)	deaths from cholera (the more deaths, the taller the bar)
● (blue circle)	public water pumps

London gets cleaned up

Doctor Snow's work helped to convince people that London must get rid of cesspools, and build a proper sewage system, with flush toilets. Work began on the sewage system in 1859. It is being updated today.

If Doctor Snow were here today ...

Doctor Snow plotted two very different things on his map – and found a connection or **correlation.** It was a really clever use of a map.

He drew his map and marked the data on it by hand. Today, he could use a **geographic information system**. Find out more in the next unit.

▶ *Broad Street is now called Broadwick Street.
This pump with no handle is a memorial to Dr Snow.*

1 Is there cholera in the UK today? Why do you think that?

2 In the 19th century, most London homes were smelly. Why?

3 Dr Snow showed information on his map in different ways. Say what these groups of things on his map tell us:
   a words   b red bars   c blue circles

4 Dr Snow found a *correlation*. What does that mean?

5 Look at the pump in the top left corner of the map. Dr Snow did not think it was the source of the cholera. Why not?

6 Suppose Dr Snow had *not* drawn the pumps in. Would his map still have helped to solve the puzzle? Explain clearly.

7 Could a map like this help us to solve problems today? See if you can come up with an example. (Food poisoning?)

Meet GIS

This is about an exciting way to use maps – on a computer.

What is GIS?

GIS stands for **Geographic Information System**. A GIS lets you bring up data on maps quickly, and look for patterns and correlations, and make decisions.

A Geographic Information System has four parts to it:

What if...
◆ ... aliens destroyed all the maps on Earth?

1 a computer

2 GIS software

Menu

3 the map you want to use

4 the data you want to display on the map
Data is anything that can be shown on a map.
For example:
- people's names and addresses
- areas at risk of flooding
- where your favourite clothes shops are
- photos of places in the map area
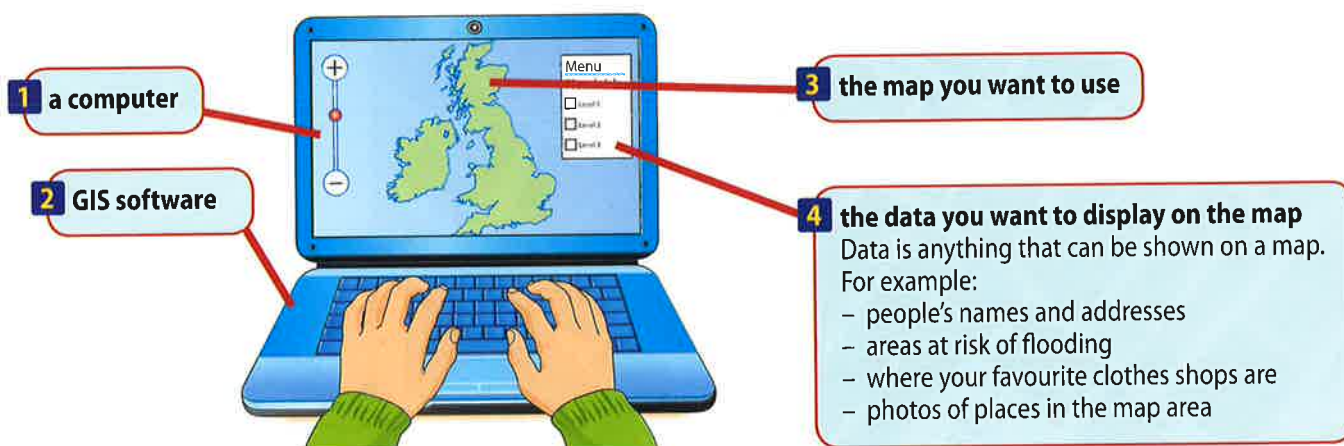
Example: you as flood warden

Imagine you are a **flood warden**. You warn local people when the river is likely to flood. You use GIS to help you.

People register for warnings. They give you their names, addresses, phone numbers, and email addresses. You type this data into your system.

Get ready

1 Your phone rings. The Chief Flood Officer tells you that a level 2 flood is on the way, and it may reach your area by 3 pm.

2 You turn on your computer and launch the GIS software.

3 You bring up the map of your area on the screen. It's like map **A** on the next page, but with no purple, and no red dots, at this stage.

4 Then you choose data from menu **B** to display on the map.
- First, from *Floods*, you choose *level 2*. An area along the river fills with purple, showing where the flood will be.
- From *Registered addresses,* you choose *at risk today*. Red dots pop on, showing those at risk in a level 2 flood.

Go!

5 Your GIS can even send out messages! So you choose *Message* from **B**. A message box pops on. You write a warning about the flood and its expected arrival time, and press *Send*. It goes off to all the people who live or work at the red dots.

6 Well done. Now you are on standby, in case people call you for help.

Is it here yet?

▲ *Your warning system means people have a chance to prepare for floods.*

A

A458

Meadow End

Blandford Way

Larkrise School

Summerhill Drive

Meadow Lane

Larkrise Street

Larkrise

A458

Vernon Drive

Shilton Park

Vernon Park

Shilton Lane

Shilton Lane Industrial Park

sbury 1ool

Joe Ross
16 Elm Park Avenue PL6 2BQ
Mob: 07674 333333
Email: rossj@mila.co.uk

Dewsbury

Willow Way

A505

Thorney Lees

Orbital Shopping Centre
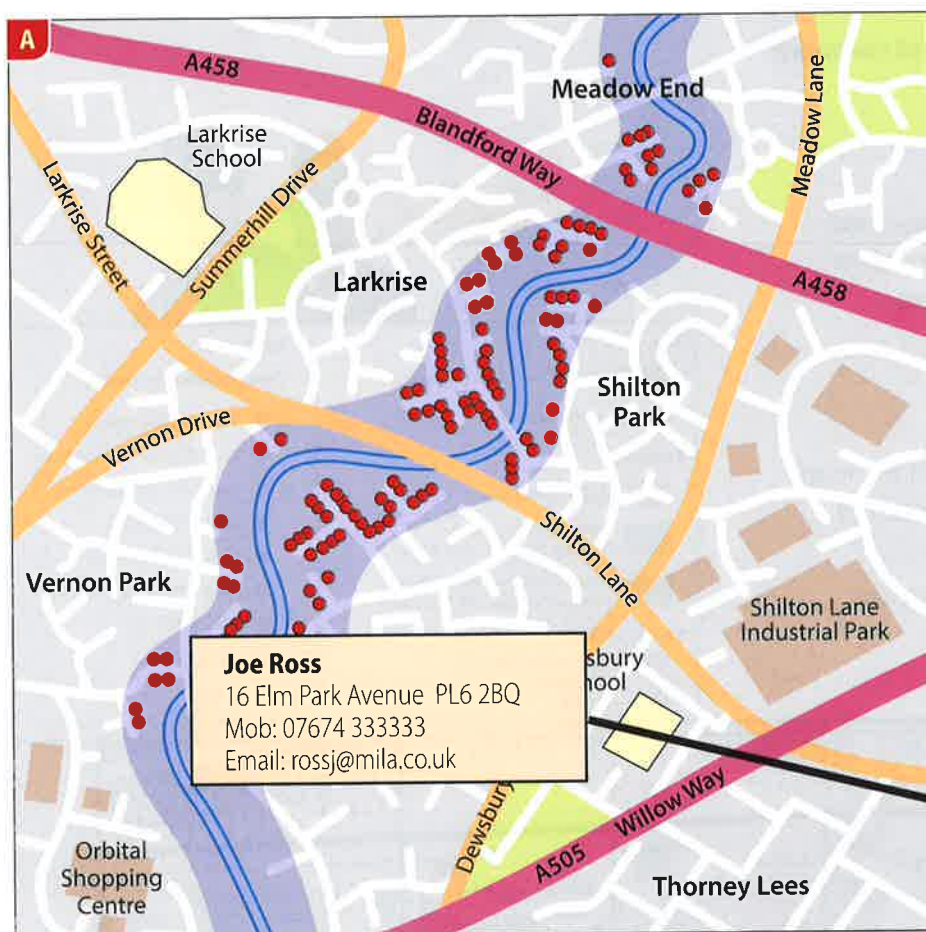
B

Menu

☑ Area map

Floods

☐ level 1

☑ level 2

☐ level 3

Registered addresses

☐ all

☑ at risk today

Message

☐

Look!
When you roll your pointer over a red dot, the details pop up. So you can phone people directly if you want to.

Other examples

Your flood warnings are just one example of a use for GIS. You will see others in later units.

But they are only the tip of the iceberg. There are *hundreds* of different uses! People think of more every day. And they all depend on maps.

Did you know?
- There are lots of flood wardens in the UK …
- … but they might not use GIS in the way you do!

1   The software is an important part of GIS. What is *software*?

2   **a**   What do the red dots on map **A** show?
    b   Other people live in the purple area too. But they have no red dots. Why not?

3   Look at **B** above.
    a   The *level 3* box is not ticked. Why not?
    b   The *all* box is not ticked. Why not?

4   Look again at **B**. What would the map show, if you *unticked*:
    a   the *level 2* box?
    b   both the *level 2* box, and the *at risk today* box?

5   Your area has lots of housing estates. How can we tell this, from the map?

6   It's another day. A level 3 flood is on the way.
    It will reach your area at 8 pm.
    (Level 3 is more serious than level 2.)
    a   Which boxes will you tick this time?
    b   Your map will look a bit different from **A** above. What do you think the differences will be?
    c   Write out the message you will put in the message box (not shown above) to send out to people.

7   In what ways is your GIS method better than Dr Snow's method? (Page 7.) See how many ways you can think of.

8   Now imagine you are Dr Snow. You are using GIS for your map and data. Draw a sketch to show your menu.

GIS in fighting crime

Here you can explore a crime map – and compare the map with an aerial photo.

GIS for the police

The police use GIS a lot. They type in lists of crimes, and where they occurred. Then they study the map on their screens, and look for patterns, and crime hotspots. These show where more patrols are needed.

Evening all!

Put your police hat on!

You are in charge of crime control for the area on the map below. The coloured dots show where crimes occurred over the last six months.

The matching photo on page 11 will help you answer the 'Your turn' questions.

Key

‖ railway and railway bridges

ꞮꞮꞮꞮ embankment

Businesses

▦ shops (all types)

▦ financial centres (banks, building societies, post office)

▦ places of entertainment (pubs, clubs, wine bars, cafes, restaurants)

Abbreviations

PW   place of worship
PO   post office
Mkt   market
Sta   station

GIS menu

Crime over last 6 months

● household burglary
● repeat household burglary
● break-ins to businesses
● assault (fighting)
● theft of or from cars
● illegal dumping of rubbish
● vandalism
○ mugging

Your turn
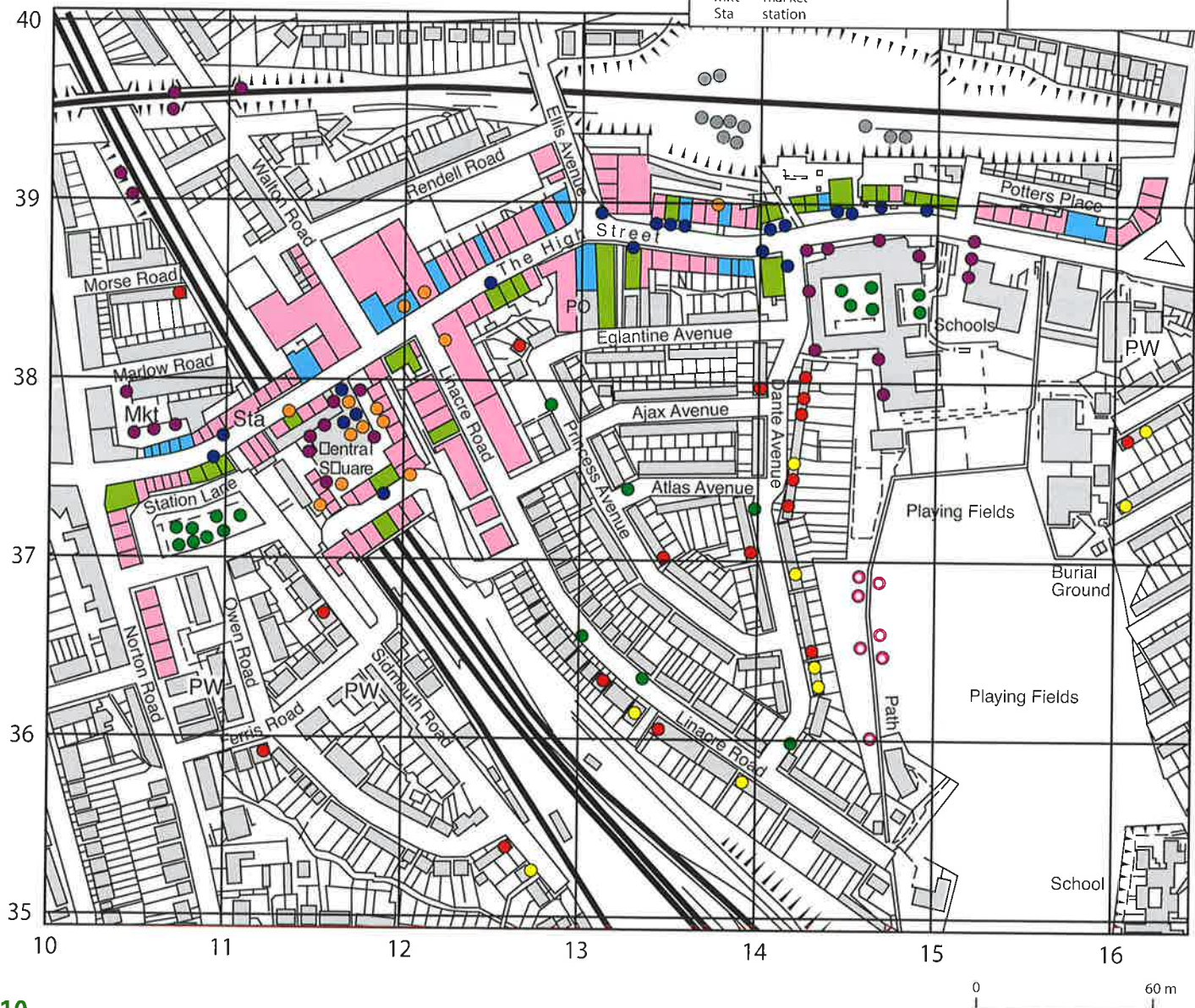
1 The map shows there were several fights along one part of the High Street, in the last six months.
   a Suggest a reason for this. (Check building use?)
   b What could you do to prevent trouble there?
   See how many suggestions you can come up with.

2 Now look at square 1436.
   a What was the main crime here?
   b Suggest a reason for this. (Check the aerial photo.)
   c What could you do to prevent this crime?
   Put your suggestions in order, best one first.

3 Yesterday two of your police team visited each house on the right of Dante Avenue (going north). They offered to write the postcode on valuable things like computers, with a special invisible ink.
   a What is a *postcode*? Give an example.
   b Why did they want to write it on things?
   c Why did they choose that road?

4 Houses on the left of Dante Avenue are burgled far less often than those on the right. Suggest a reason.

5 Which grid square was worst for this crime? And why? (Check the photo.)
   a theft of or from cars   b illegal dumping of rubbish

6 Vandalism is a problem too. Windows get broken, phone booths smashed, and walls sprayed with graffiti. It is a special problem in squares 1438 and 1137. Suggest reasons for this.

7 A *crime hotspot* has more crime than the places around it. Where is the main crime hotspot in the map area? Try to give reasons for this.

8 Look at the aerial photo again.
   a Is it a good match for the map? Give it a score out of 10.
   b Should the police get rid of the map, and show the crime data on the photo instead? Give reasons.
   c In fact the police usually have aerial photos like this one in their GIS menu. Is that a good idea? Explain.

GIS makes me nervous.

More about the data

There are two things you need to know about the data, to help you understand GIS. Find out here!

GIS depends on data

GIS is no good without data! Its purpose is to display data on a map, in a way that helps you find patterns, and make decisions, and take action. There are two things to note about the data. Let's have a look at them.

1 The data is in layers

In GIS, the data is well organised. Each type of data has its own layer.

A
- names and contact details
- flood levels
- map of your area

B
- cholera deaths
- pumps
- Dr Snow's street map
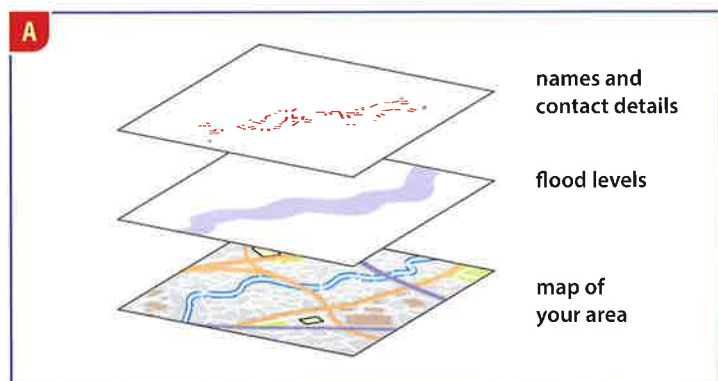
For your flood warning system in Unit 1.2, these are the layers. Each layer has one theme. The map of your area is at the bottom.

If Doctor Snow in Unit 1.1 had had GIS, he would have organised his layers like this. His street map of Soho is at the bottom.

Another example

Suppose you are investigating road safety around the schools in your area. Then you might want a bigger stack of layers. For example, look at **C**.

Working with layers

With GIS, you can …

- ◆ turn layers on and off; you do this at the menu
- ◆ bring up two or more layers together, so that you can look for patterns and correlations
- ◆ make changes to layers
- ◆ add more layers.

Taking action

If you do find a pattern, you might want to take action, like Doctor Snow did.

For example, suppose you find that there have been several accidents at a zebra crossing near your school – and the crossing has no lollipop person. You might want to tell the head of your school, or the local council.

C
- fast food places
- schools
- pedestrians hit by bikes in last 10 years
- pedestrians hit by cars in last 10 years
- lollipop ladies / men
- zebra crossings
- traffic lights
- street map

2 The data must be at the right places on the map

Think about your flood map on page 9. It would be no good if the dots came up in the wrong place, far away from the river.
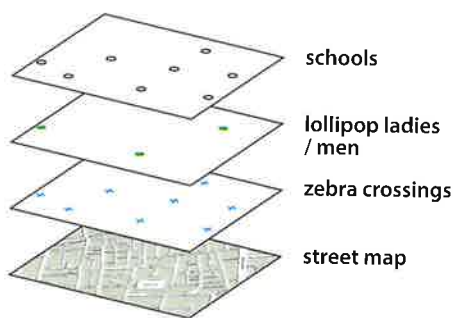
Or suppose you are checking the safety of road crossings near school. It would be no good if the school popped up in the wrong street.
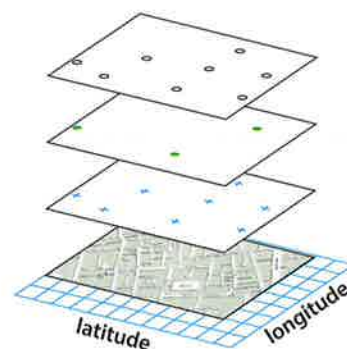
Each piece of data must appear at the right place on your map. In other words, it must be at the right latitude and longitude.

Ways to find latitude and longitude

In GIS, data is *always* linked to latitude and longitude. So suppose you are out collecting data. For example, finding out where the zebra crossings are, for your road safety project. How would you find their latitude and longitude? Here are three ways.

1 Use postcodes

You could use the **postcodes** for buildings next to the crossings. GIS software can work out latitude and longitude from postcodes. So it knows where to put dots on the map.

2 Use a mobile phone

Most mobiles have a built-in **GPS** or **global positioning system** that gives the phone's latitude and longitude. So if you are at a zebra crossing, the phone can display the coordinates. You can save them, or text them to your teacher. (You could take a photo of the crossing too.)

3 Use a GPS unit

There are also special GPS devices that give your latitude and longitude. Your school may have some of those.

▼ *Most mobile phones give latitude and longitude. Great for geography!*

Other uses for GIS

You met some uses for GIS earlier. Now you'll meet more.

Hundreds of uses

There are hundreds of uses for GIS. Here are a few more examples.

1 Delivering parcels

You run a delivery service. You have 50 parcels to deliver this morning.

You type in the addresses and contact details. The locations pop up as dots on your map. Then the software draws on the best route for you. Brilliant!

Now you press a *Message* button. And minutes later, 50 people receive a message that you're on the way, with your estimated arrival time.

2 Sending an ambulance

Mr Granger is ill. He dials 999, and is put through to the ambulance service.

The operator asks for his address, and types it in. His location flashes up on her map.

The map also shows where the ambulances are. The operator contacts the one on standby nearest to Mr Granger.

The ambulance crew go to him as fast as they can.

David Granger
11 Edmund St
IT37 4N1
03842 135519
Status: SCA

Ambulance 3
((●))
CALLING
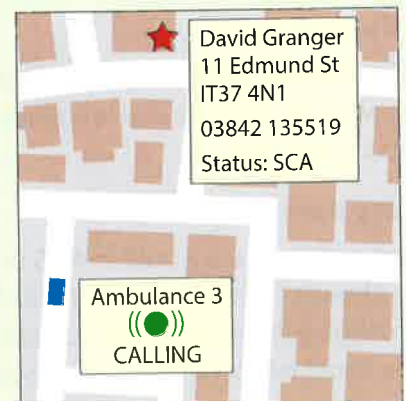
3 Choosing a site for a windfarm

You are choosing a site for a windfarm. It must be exposed, and windy!

But not too close to people's homes, because turbines make a swishing sound. And not in the way of migrating birds.

You can use GIS to display the data: land height, wind strength and direction, where the buildings are, and wildlife patterns.

It makes choosing a site quite easy!
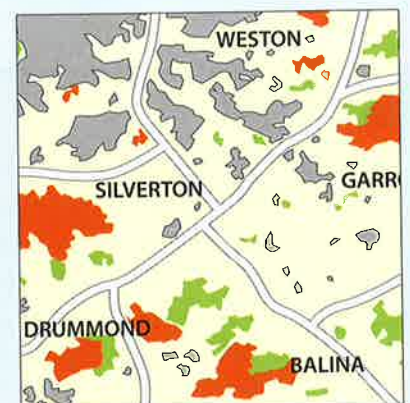
4 Saving chimps

And now you are helping to save chimps in Central Africa. (You are amazing.)

They are in danger because hunters have been trapping and selling them.

You use GPS and hidden cameras to collect data about chimp locations. And GIS to show the data on satellite images and maps. Then you mark out the area for the rangers to protect.

chimp locations

river

country border

5 Driving with sat nav

Sat nav is GIS that does just one job: it gets you places.

You put in the address you're going to.

A map comes up, showing your car's location (via GPS). As you drive, the map scrolls, and a voice tells you what to do next. (*Turn right in 700 metres.*)

Some sat navs can detect a traffic jam ahead, and find another route for you.

Exit 64 right

Menu

Turn in 700m

6 Using Google Earth

Google Earth is a form of GIS. It displays satellite images. You can call up maps too.

You can turn on layers. And add lines (paths), and shapes (polygons), and place markers.

You can save images, and display data on them later. On the right is part of a big class display. The dots show students' homes. The colours show how they travel to school.

school
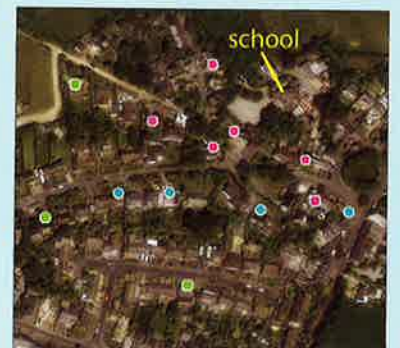
Your turn

1 Here are two statements about GIS.
  a It helps people do their jobs more efficiently.
  b It helps people make good decisions.
  For each statement, decide whether you agree. Then see if you can give evidence to back up your answer.

2 Look at examples 1 – 5. Do you think paper maps might be more helpful than GIS, for any of these uses? Give reasons.

3 Look again at 1 – 5.
  a Which of these uses for GIS appeals to you most? Why?
  b Which might play a part in your life, one day?

The big picture

This chapter is about how Earth's population of humans is growing.
Here's the big picture …

- Our numbers have been growing fast for the last 250 years or so.
- We are also living longer than we used to.
- We are spread unevenly around Earth.
- The population is growing at different rates in different countries. (It's *falling* in some countries.)
- Our rising population has an impact on Earth, and on other species.
- The total population will continue to increase for some time.

Your goals for this chapter

By the end of this chapter you should be able to answer these questions:

- Roughly how many people are there on Earth right now?
- What do these terms mean?
  population   *population distribution*   *population density*
- How has Earth's population grown since 10 000 BC? (You should be able to sketch the graph, and add some dates.)
- Which parts of Earth are the most crowded, and which the most empty? (Describe the overall pattern.)
- What does *life expectancy* mean, and how is it changing – and why?
- How is Earth's population predicted to change, up to 2100?
- What problems might a country face, if its population … … keeps rising?   … keeps falling?
- What can I say about the UK's population? (Give at least four facts.)
- The rising population has an impact on Earth, and on other species. What examples can I give? (At least five.)

And then …

When you finish the chapter, come back here and see if you have met your goals!

Did you know?
- Around 360 000 new babies are born every single day.

Did you know?
- The world's population is expected to reach 8 billion by 2025.
- It was 6 billion in 2000.

What if...
- … the number of people on Earth kept on growing and growing?

What if...
- … we ran out of land to live on?

Why...
- … can't we live to be 158?

Your chapter starter

Look at the photo on page 16.

What has it got to do with population?

About how many babies were born around the world on the same day as this baby?

How long do you think this baby is likely to live?

How many babies is she likely to have, when she grows up?

It's twins!

Our numbers are growing fast

Here you'll discover how quickly our numbers are rising – and why.

Here we go!

NO HOMO SAPIENS (THAT'S US!)

Where are you?

Over here!

170 MILLION OF US

900 MILLION OF US

Haven't I seen you before somewhere?

OVER 7000 MILLION OF US (7 BILLION)

HELP!

200 000 years ago　　　2000 years ago　　　200 years ago　　　Today
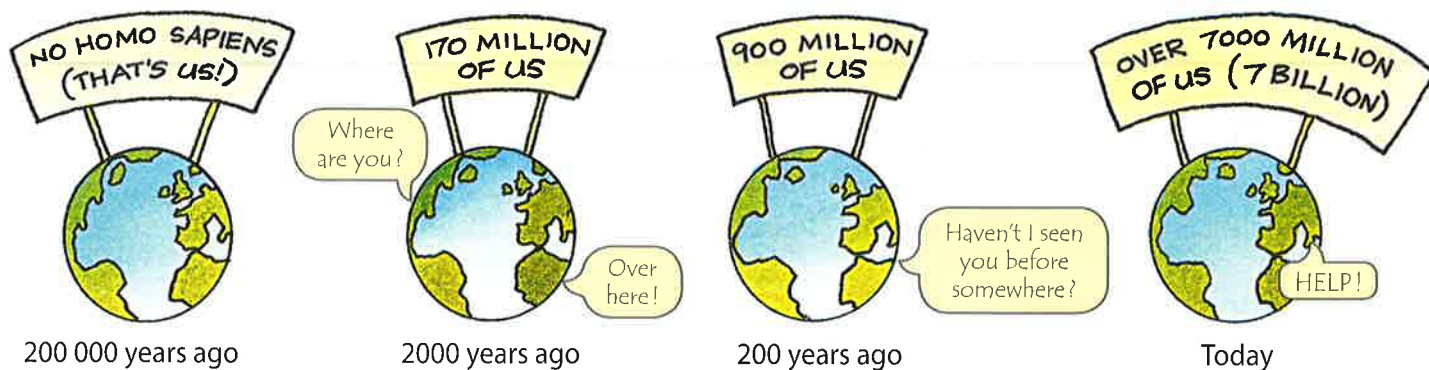
How does the population rise so fast?

1750

1780

BO AND ELLA REST IN PEACE

1820

In 1744, Bo and Ella fell in love. They got married and had **4** children.

All 4 of these had children of their own. **18** altogether.

16 of the 18 in turn had children of their own – **76** altogether.

So Bo and Ella's family kept on growing – and it is still growing today.
It has been like this for families all over the world, for centuries.
So it is easy to see how the population has risen so fast.

But what about deaths?

Every year, millions of humans die. But the population still keeps rising!

NATURAL INCREASE = BIRTH RATE − DEATH RATE

Just you wait!

We won. By 79 million.

For example in 2012, about 55 million people died. From old age, illness, injuries, and hunger.

But far more new babies were born that year – about 134 million altogether.
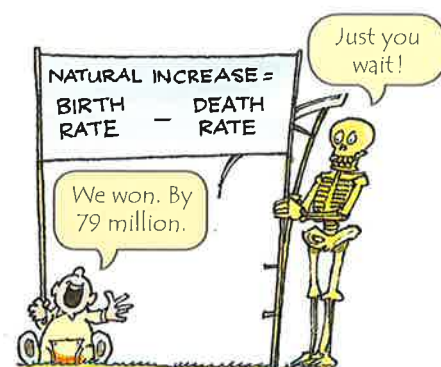
So the world population grew by about 79 million in 2012. This was an increase of about 1.2%.

A graph of world population

We humans first appeared about 200 000 years ago, in the Horn of Africa.
We started spreading around Earth about 60 000 years ago.

For a long time, there were not many of us. But look at this graph. The blue
line shows how our population has grown since 10 000 BC.

A Before 10 000 BC, we were hunter gatherers.
Experts think our population stayed steady at about
3 million, for a long time.

I Where will it all end?

7 billion in 2012

B Then, around 10 000 BC, we started
to grow food and rear animals. We were
farming! And our population began to rise.

H The Industrial Revolution
started around 1760. And the
population began to shoot up.

6 billion in 1999

5 billion in 1987

G The Romans invaded Britain
in 43 AD. At that point, the world
population was about 200 million.

4 billion in 1974

3 billion in 1959

F As our farming methods
and tools improved, our
numbers grew faster.

2 billion in 1927

1 billion in 1804

World population (billions)

6

5

4

3

2

1

0

10 000 BC   8000   6000   4000   2000   AD 1   1000   2000

C All this time, until about 3300 BC,
we used stone for tools. So we were
in the Stone Age!

D But around 3300 BC, we
discovered how to make bronze.
The Bronze Age had begun.

E Then about 1200 BC, we learned how
to produce iron. It was better for making
things. So the Iron Age started.

Your turn

1 The human *ntalppouio* grows each year because there are
more *irthbs* than *stedah*. Unjumble the three words!

2 **a** Look at the graph above. What does it show?
   b Describe the shape of the graph line.

3 Look at **A** on the graph.
   a How do hunter gatherers live? (Glossary?)
   b The population of hunter gatherers was low (around
   3 million). See if you can think of reasons for this.
   (For example, what dangers might they have faced?)

4 Now look at **B**. The spread of farming helped our population
to grow. See if you can explain why.

5 Look at **D**. Bronze can be used for tools and weapons.
Suggest reasons why it helped the population to grow.

6 Look at **H**.
   a What was the Industrial Revolution? (Glossary?)
   b See if you can explain why it helped the population
   to start rising sharply.

7 Now for some numbers.
   a When did the population reach 1 billion?
   b How many years did it take to go from 1 billion
   to 2 billion?
   c How many years did it take to go from 3 billion
   to 6 billion?

8 **a** Do you think the world's population can just keep on
   rising, like it did for the last 200 years? Give your answer,
   and reasons, in not less than 35 words.
   b What kinds of things might stop it rising?

So where is everyone?

In this unit you'll see how we are spread unevenly around Earth – and explore some reasons why.

From empty to crowded

Some places, like Antarctica, are empty. People only visit.

Some are **sparsely populated**. For example, much of Australia.

Some are crowded, or **densely populated**. Like Macau, in China.

Earth's population distribution

We began spreading around Earth about 60 000 years ago. Map **A** shows where we live today. The deeper the colour, the more people there are.

A

Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
Antarctic Circle

Key

very densely populated areas with large cities and towns

fairly densely populated rural areas and small towns

sparsely populated rural areas with small towns and villages

only isolated towns and villages
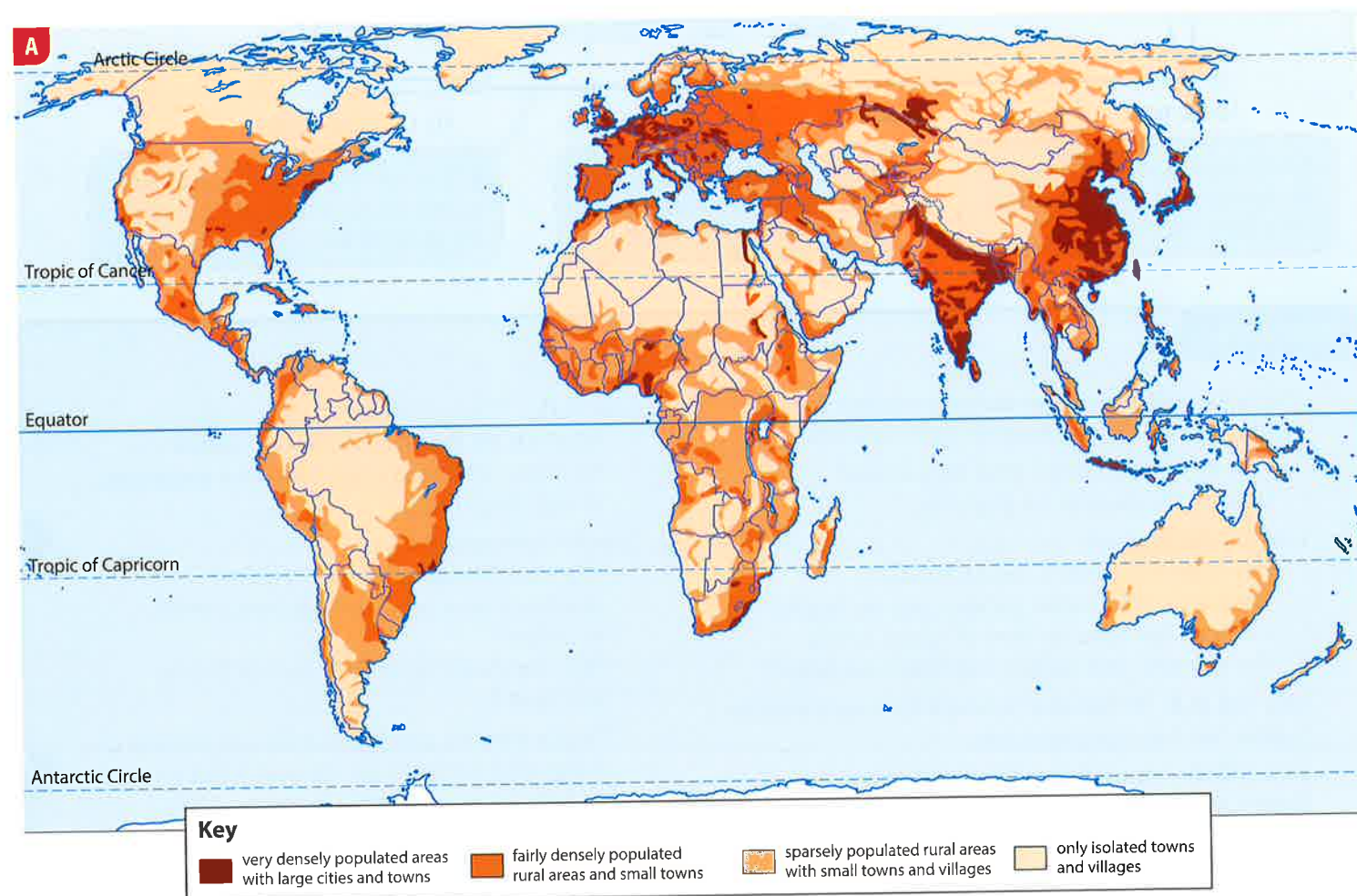
Your turn

The world map on pages 140 – 141 will help with these.

1 See if you can explain what these terms mean. (Use the glossary only if you get stuck.)
 a densely populated   **b** sparsely populated
 c population distribution   **d** population density

2 Look at map **A**. Which two *continents* have the largest areas of very high population density?

3 Name two *countries* that appear to be:
 a very crowded, overall   **b** very lightly populated

4 The climate affects all living things.
 a What's the climate like at **P** on map **B** below?
 b This drawing shows what crops need:

① some **warmth** to help them grow and ripen
② some **sunlight** so the leaves can make food
④ **soil** for minerals
③ **water** which the roots take in
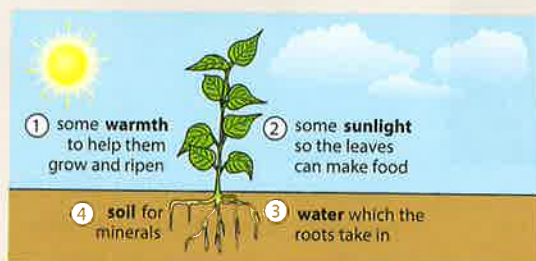
 Will crops grow well at **P**? Give reasons.
 c Is the population density at **P** high, or low? Give as many reasons as you can to explain why.

5

Place	Country	Climate	Population density	Reasons
P				

a Make a table like the one started above, but much bigger. Leave room to write quite a lot in the last column.

b Write the letters **P**, **Q**, **R**, **S** and **T**, from map **B**, in the first column.

c Name the countries they're in, in the second.

d Describe the climate at each place, in the third column. (Use the key, and things you know already.)

e In the fourth column describe the population density at each place, using one of these phrases:
 very high   fairly high   fairly low   very low

f In the last column give as many reasons as you can, to explain why the population density is like this.

Key

equatorial
warm and wet all year

tropical
hot and wet, with dry season(s)

desert
very dry, with very hot summers and cooler winters

mediterranean
hot dry summers, warm wet winters

maritime
warm summers and cool winters, wet

continental
warm summers and cold winters, wet

polar
very cold all year (especially in winter), and dry

mountain
cold because it is high, with heavy rain or snow

B
Arctic Circle
Q
S
Tropic of Cancer
R
P
Equator
T
Tropic of Capricorn
Antarctic Circle

The world's climate regions
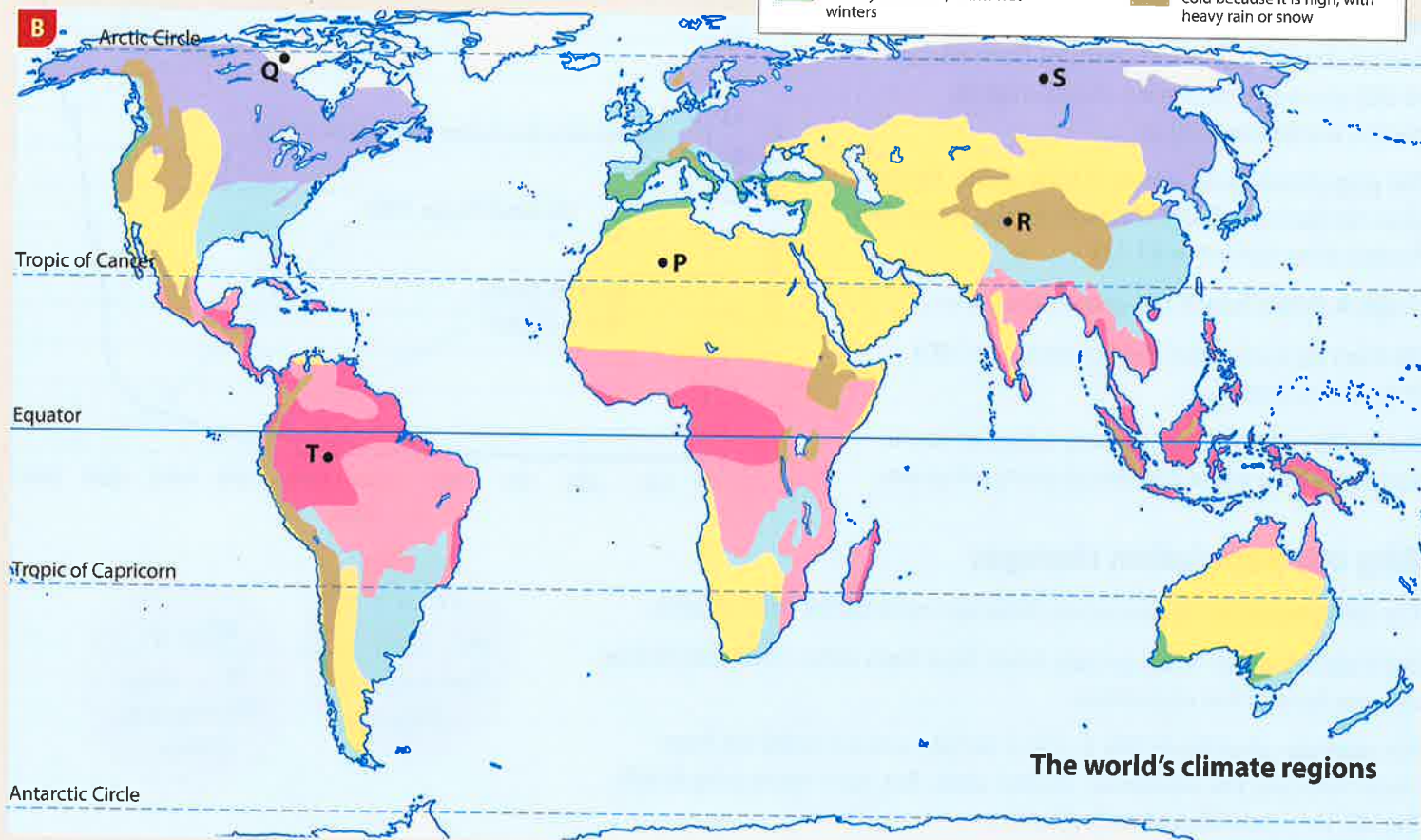
The population of the UK

How has the UK's population changed over the centuries?
Find out here.

It's growing!

Look how the UK's population has changed.
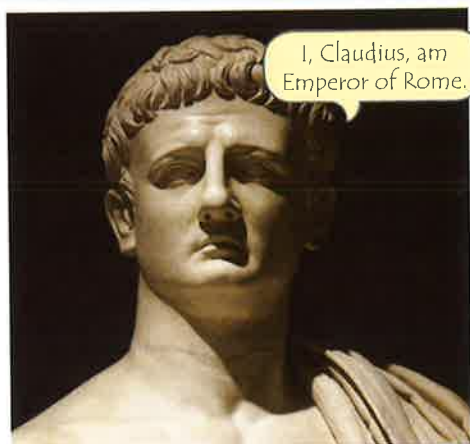
I, Claudius, am Emperor of Rome.

When I invaded your country in 43 AD, the UK's population was around 1 million. People could expect to live to be 30, on average.

I am Queen Elizabeth I. Henry VIII was my papa.

When I became queen in 1558, the UK's population was about 6 million. People could expect to live to be 40. (But I myself will reach 69.)

I wonder who I am.

I was born this morning. The UK's population is around 64 million. My life expectancy is 83 years. But there's a good chance I'll make 100!

A graph for the UK's population

20 000 years ago, during the last ice age, nobody lived in the UK. It was too cold. But from about 12 000 years ago, as the ice sheets melted, people started moving in.

The population grew slowly. It took about 10 000 years to reach a million. That was its size when the Roman army arrived in 43 AD.

Graph **A** shows how it has grown since then.

We can't be sure about the figures up to 1801. They are estimates.

But in 1801, the first census was taken, to count everyone. Now there's a census every ten years.

A — Graph of Population (millions) against Year, showing markers for: the Black Death, 1348 (a plague); the Great Plague, 1665; the Industrial Revolution began around 1760; World War I, 1914 - 1918; World War II, 1939 - 1945.
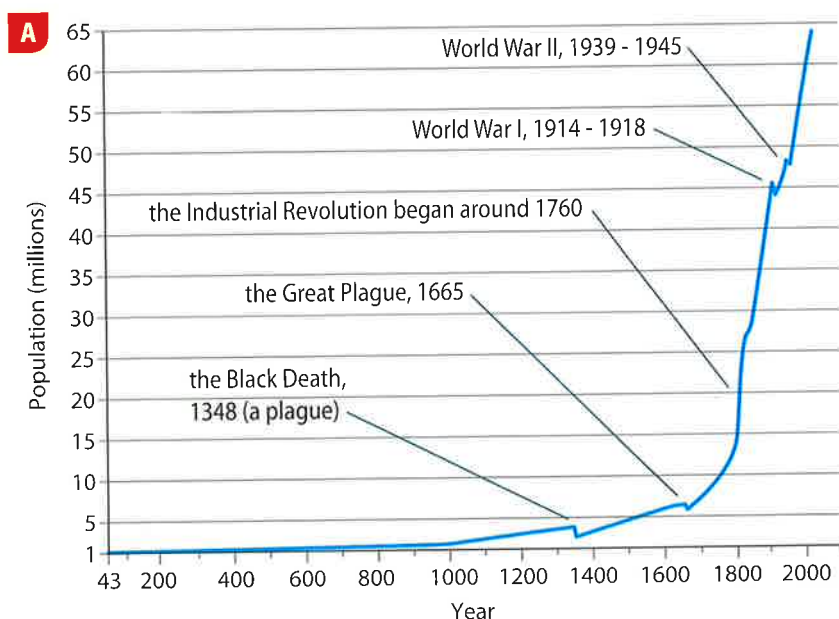
Why our population changes

The UK's population grows when there are more births than deaths.

But it also changes when people move here from other countries to live, or leave here to live elsewhere.

For example after World War II, many people arrived in the UK from South Asia and the Caribbean, to find work. But even more people left the UK, for a new life in North America.

What if...
- ... there were more deaths than births?

What if...
- ... aliens abducted all the children?
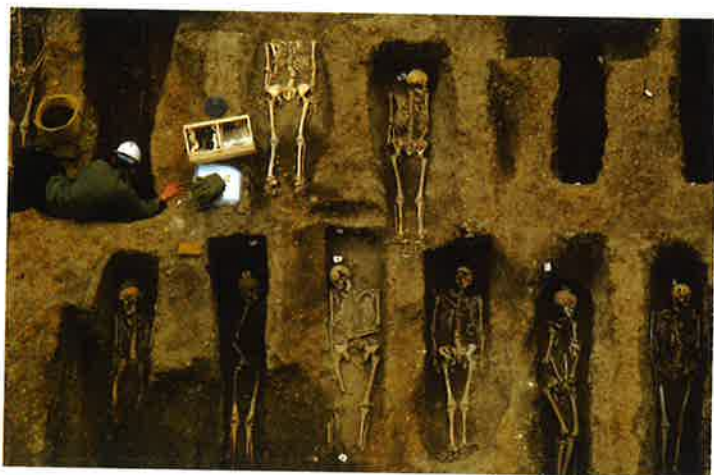
▲ The Black Death was the bubonic plague which struck Britain in 1348. It killed off half the population. These remains of victims were uncovered in London.
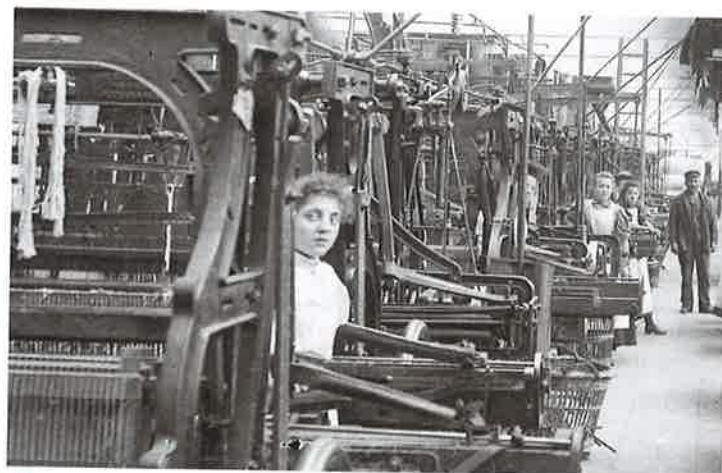
▲ The Industrial Revolution gave us machines powered by running water, and steam. Lots of factories were set up. This one made blankets. The photo was taken in 1898.

Life expectancy

Life expectancy means how many years a person can expect to live.

If life expectancy is 80 years, then people can expect to live to be 80. But that's an *average*. Some will live longer, and some die earlier.

B shows how life expectancy has changed over the years, in the UK.

B

(graph: Life expectancy (years from birth) vs Year, 1901–2011, showing females and males)
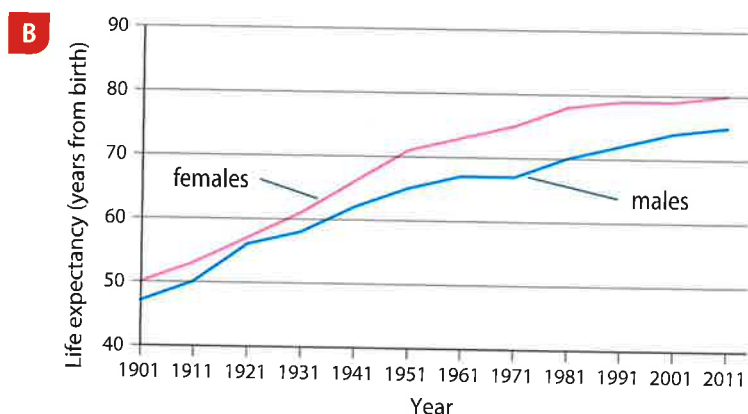
▲ Happy 97th birthday! There's a good chance that you too will live to be 97 – and even older!

◀ All over the world, women live longer than men. The average life expectancy for a country is the average of the male and female values.

Population around the world

Here we look at population growth and life expectancy around the world.

Population growth around the world

Earth's human population is growing at about 1.2% a year. That might not seem much. But it adds over *80 million people* to Earth each year. Look at the figures on the right, for 2010.

The population is not growing at the same rate everywhere. Look at map **A**. Deep red shows where it is growing fastest.

Earth's population in 2010

At start of year: 6809 million
At end of year: 6890 million
Increase: 81 million
So growth rate: 1.2 %

A

Arctic Circle

Tropic of Cancer

Equator

Tropic of Capricorn

X

Key
population growth rate per year

- more than 3%
- 2–3%
- 1–2%
- 0–1%
- less than 0%
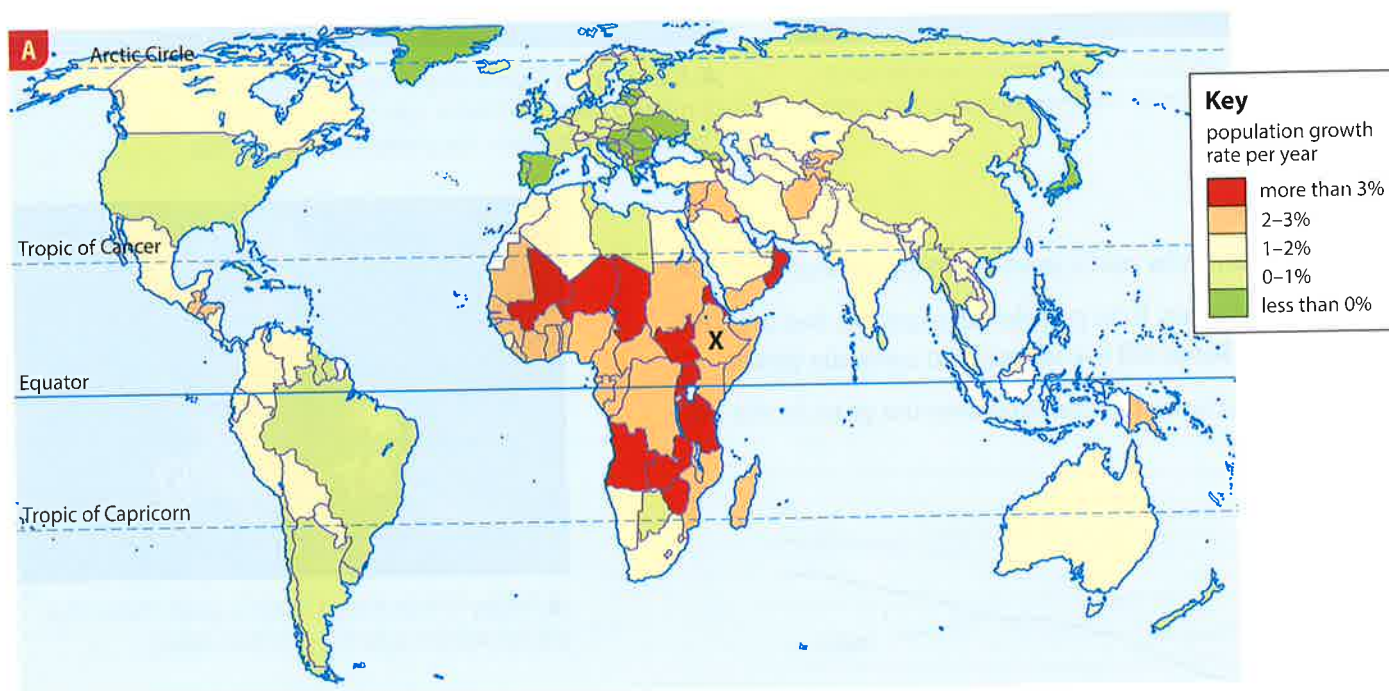
Note that:

- Population growth is generally faster in poorer, less developed countries, and slower in richer countries.
- Population is rising fastest in Africa.
- Population is *falling* in some countries. Look at the deep green.

Why are growth rates so high in some places?

Population is growing fastest in some of the world's poorest countries. Why? Because in these countries …

- people think of children as a form of security. They can earn money, or help on the farm. But some won't survive. So a big family is welcomed.
- many women have no access to advice about spacing out their children. They may have babies one after another.
- many girls have little choice. They leave primary school after a year or two. They may be married very young. They may have little say in how many children they have. Their husbands are in control.

▼ *In Ethiopia, at X on map A, half of all girls are married by the age of 18. Nearly one in five is married by age 15.*

China: an exception

China is the world's most populous country, with over 1350 million people. It is not so wealthy. But it has a low population growth rate: about 0.5%.

It was not always so. 50 years ago, the population was growing at about 2.4% a year. But in 1979, the government ordered that families should have only one child each. Parents who had more could be fined, or punished in other ways.

Even with its low growth rate, China still gains nearly 7 million people every year. (And now the one-child policy has been relaxed.)

Life expectancy around the world

Life expectancy varies around the world too. In Japan, people can expect to live to be 85, on average. (Women a little longer, men a little less.) But in Sierra Leone, life expectancy is 48 years. Map **B** shows how it varies.

Low life expectancy is the result of poverty. People may not have enough food, and only dirty water to drink. There may be no doctors to help them. But overall, as countries develop, life expectancy rises.

▲ *Many millions of children in China have no brothers or sisters.*

Key

average number of years a baby can expect to live

over 75 years
55–75 years
under 55 years
no data
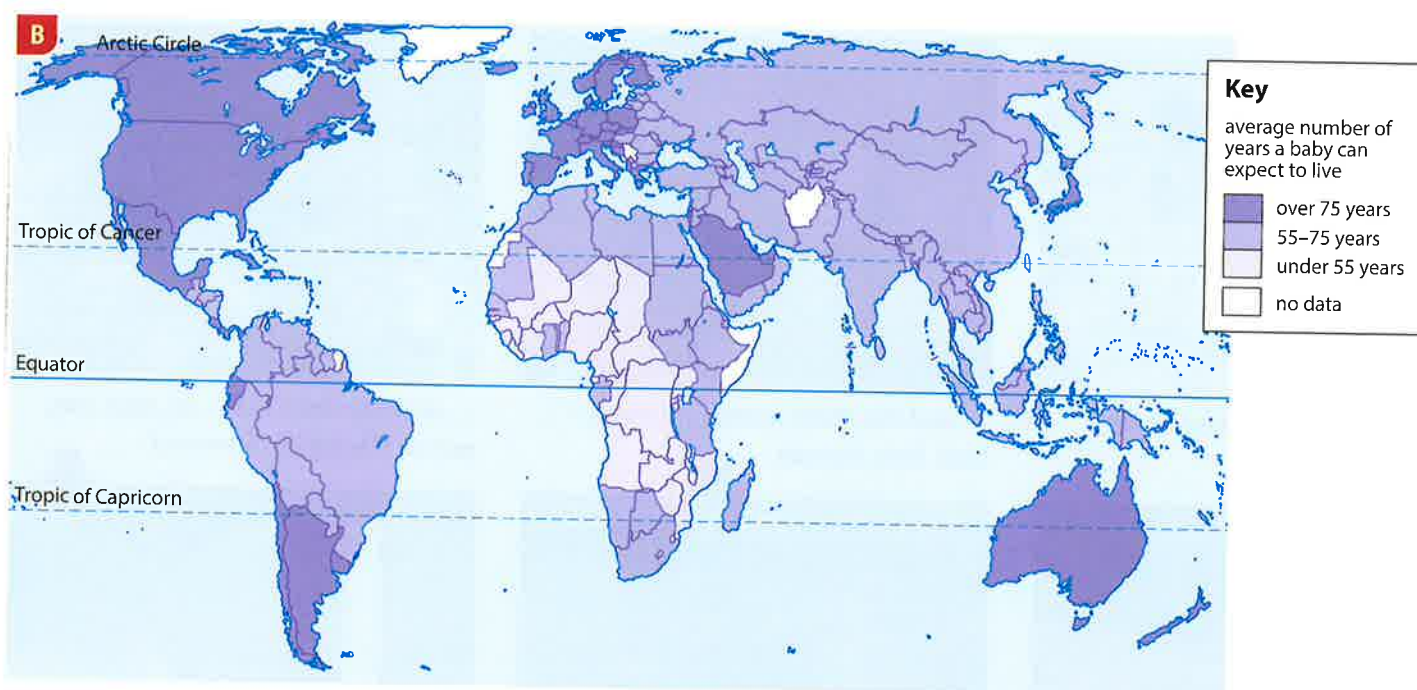
Your turn

1 Use map **A** and pages 140 – 141 to name three countries:
   a where the population is growing at over 3% a year
   b where the population is falling

2 Where girls receive a good education, the population tends to grow more slowly. See if you can explain this.

3 China set out a one-child policy in 1979. Why do you think it decided to do that?

4 Life expectancy is usually higher in richer, more developed countries. See if you can explain why.

5 a In which continent is life expectancy lowest, overall?
   b Name two countries where life expectancy is under 55.
   c Name two countries where life expectancy is over 75.

6 High population growth and low life expectancy usually go together. Try to name four countries as evidence for this.

Our impact on our planet

This unit is about the impact of our growing population on our planet.

Growing fast

Our numbers are growing fast.

Just think. By this time tomorrow, Earth will have an extra 225 000 humans. By this time next year, there will be over 80 million more of us. Two years from now, there'll be over 160 million more.

It will keep on going like this for some time.

Where will we all fit? Will we have enough food? Will we have enough water?

▲ *More new arrivals …*

The demand for resources

The more of us there are, the more of Earth's **resources** we use up. For example, the more of us there are …

… the more food we need, to feed us all …

… and the more homes we need – huts, flats, houses …

… and the more fuel – oil, coal, gas, petrol, electricity, firewood – …

… which means more land cleared for farming, and more minerals dug up to make fertiliser.

… which means more land cleared for homes, and more timber, stone, clay, and sand used up.

… which means more trees gone, and more land cleared for oil and gas wells, coal mines, power stations.

We even compete with each other for resources. There have been wars over land, and oil! Some people predict that one day, quite soon, there will be wars over fresh water.

Our impact on Earth

We think we are the cleverest species on Earth. We make use of its resources in all kinds of ways. But it's not all good news.

The more land we take over, the less there is for all the other living things. We think that over 100 000 species a year are dying out now. Even pandas are at risk!

The more resources we use, the more waste we create. It gets dumped on land, and at sea. Some rots away quite fast. But some will hang around for centuries.

We cause other pollution too. Like **acid rain**, which kills trees (above). And scientists say we're helping to bring on **global warming** by burning fuels.

Those are just some of the ways we harm our planet.
The larger the population, the greater our impact will be.

So is there no hope?

There is hope.

- We now see that we must live in a more **sustainable** way, which does not harm us or other species, and is not wasteful.
- We are trying to repair some of the damage we've done.
- Our population is not likely to keep growing. Some experts predict that it will rise to around 9 billion by 2050, then fall. Find out more in the next unit.

What if...
- ... we each looked after our part of the planet really really well?

Did you know?
- If everyone lived like people in the richer countries, we'd need 4 planets to support us.

Your turn

1 a What are *resources*? (Glossary?)

  b These are some of Earth's resources:
    water   soil   wood   metal ores   oil
    Choose just two, and say how you depend on them.
    Give your answers as spider maps, like this:

    I depend on soil because it is needed to grow...
    food crops I eat, such as rice and beans
    cotton, that I wear
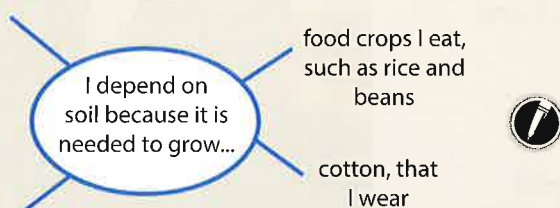
2 Look at the resources listed in question **1b**.
  a Which of them would you die without? Explain why you chose this / these, and not the others.
  b Which could we run out of? Explain your choice.

3 *Pandas feed on bamboo. Once there were plenty of pandas in the bamboo forests of Vietnam and China. But the forests were cut down for farming, and to make way for towns. Now there are fewer than 2000 pandas left on Earth.*
   Think about this. Then make up a conversation between a panda mum and her baby, about humans and their babies.

4 Suppose the human population doubles in the next 50 years. What problems do you think that might cause:
  a for humans like you?
  b for other animals?
     (Don't forget things like household rubbish, and sewage.)

5 Look at this idea.
   Do you agree with it?
   Give your reasons.
   ONLY ONE CHILD PER FAMILY FROM NOW ON!

What does the future hold?

How many humans will Earth have by the time you are an adult? This unit looks ahead.

Predicting population growth

In 1950, the world's population was 2600 million (or 2.6 billion).
In 2000, 50 years later, it was 6100 million.
What will it be by the year 2050? Experts try to predict. Look at graph **A**.

A
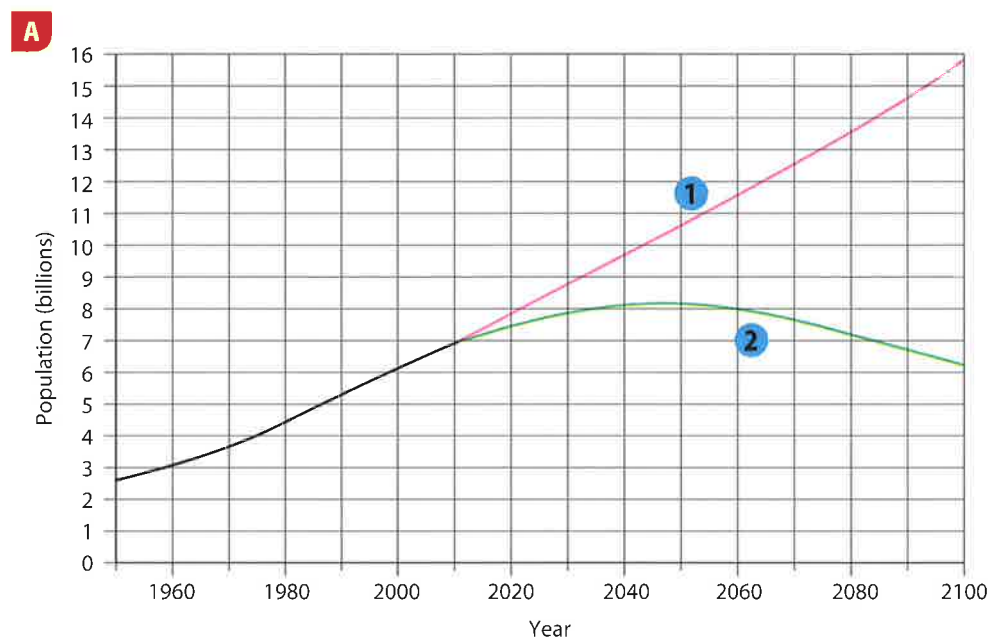
① This line shows how the population will rise if high growth continues. It will reach about 10 billion by 2050, and 16 billion by 2100.

② This shows what many predict: that growth will slow down. The population will reach 9 billion or so by 2050, and then start to fall.

Let's take **2** as more likely, for the rest of this unit.

Why might the population fall?

◆ As people grow better off, they tend to have fewer children. They don't need them as security. Instead, they usually try to give each child as good a life as they can.

◆ When women have more education and take up work outside the home, they tend to marry later and have fewer children.

The trends

◆ Life expectancy is expected to rise everywhere. By 2050 there may be around 1.5 billion people aged over 65 – and millions of people over 100!

◆ Poorer countries will still have the highest birth rates. Africa's population is expected to double by 2050.

◆ Some rich countries, such as Germany and Japan, face a different problem: too few babies, many elderly people, and not enough workers!

▲ It is predicted that India will have 1.6 billion people by 2050, and be the most populous country in the world.

▲ Germany has the lowest % of children in Europe. The government is spending lots on child care centres, to encourage women to have babies.

Compare Germany and Ethiopia, for example

Look at **B**. This bar graph shows that Germany and Ethiopia had almost the same population in 2009.

But Germany's population is *falling* by about 0.2% a year. Ethiopia's is *rising* by over 3% a year. Compare the predicted bars for 2050.

Their population structures will be very different too. Look at **C** and **D**. The bar graphs show the % of the population in different age groups.

B

Population (millions)

2009   2050 (predicted)

Germany ▢   Ethiopia ▢

Germany, 2050

C **Predicted age structure**

65 and over
15 – 64
0 – 14

0   10   20   30   40   50   60   70
% of population
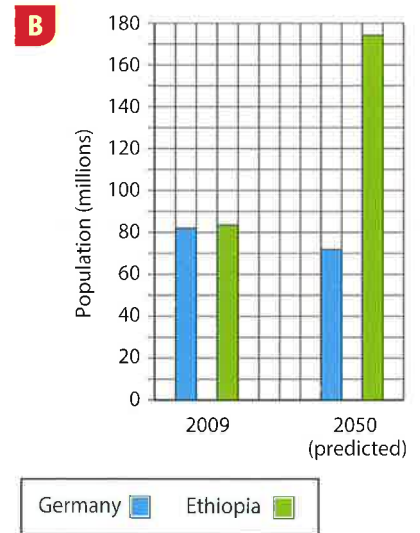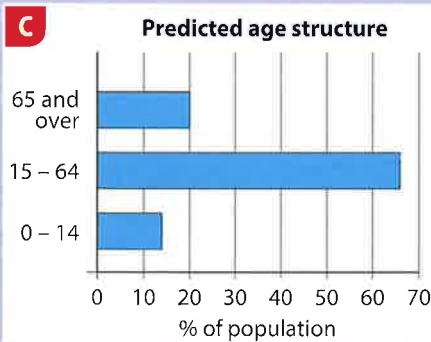
There will be more people aged over 65 than under 15. So this is an **ageing population**.

People of working age will have many elderly people to support.

The % of young people is low. When they grow up, there won't be enough of them to do all the work.

So Germany will need immigrants from other countries.

Ethiopia, 2050

D **Predicted age structure**

65 and over
15 – 64
0 – 14

0   10   20   30   40   50   60   70
% of population
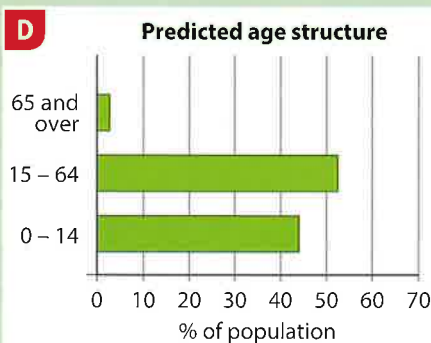
Life expectancy is rising in Ethiopia. Even so, the % of people aged 66 and over will still be low by 2050.

But look at the high % aged under 15. Ethiopia will have a very **young population**.

With so many young people, many may find it hard to get work when they grow up.

What about the UK?

The UK's population is expected to keep rising. It may reach 77 million by 2050. (It is about 64 million today.)

▲ *By 2050, over 40% of the people in Ethiopia will be under 15.*

Your turn

1 Look at graph **A**. Which would be better for Earth?
  a line ❶   b line ❷
  Write down your answer, giving at least two reasons.

2 In 2009, Ethiopia and Germany had almost the same population.
  a Which has the larger population today? Explain why.
  b Describe one problem which each country could face by 2050.

3 We can't be sure about population size in the future. Anything could happen! How might these affect it?
  a A giant asteroid, 15 km across, strikes Earth.
  b A deadly superbug appears. Antibiotics can't kill it.
  c The Third World War breaks out.
  d Countries start paying women to have children, because they need more workers.
  e Global warming melts all the ice in Antarctica.

3 Urbanisation

The big picture

This chapter is about **urbanisation** – the rise in the % of people living in towns and cities. Here's the big picture …

- 300 years ago, a small % of the world's population lived in urban areas.
- Then the Industrial Revolution began, and spread from the UK to other countries. People flocked into towns and cities to work in factories.
- Today, many countries are highly urbanised. For example in the UK, 80% of us live in urban areas.
- The % urban is lowest in Africa and Asia – but is increasing fast.
- Hundreds of millions of people around the world live in slums.
- We are trying to make cities better places to live in.

Your goals for this chapter

By the end of this chapter, you should be able to answer these questions:

- What do these terms mean?
  rural area   *urban area*   *urbanisation*
- What was the *Industrial Revolution*? Where did it start? About when?
- How did the Industrial Revolution affect Manchester?
- The Industrial Revolution led to an increase in urbanisation in the UK and other countries. Why?
- What is the pattern of urbanisation around the world? (Give at least three facts.)
- What are the benefits and disadvantages of living in urban areas? (See how many you can give.)
- What are *slums*? Why do they form? What are they like?
- What does *sustainable* mean? And in what ways is Masdar City sustainable? (Give at least four ways.)

And then …

When you finish the chapter, come back here and see if you have met your goals!

Did you know?
- Jericho, in the Palestinian Territories, is said to be the world's oldest city …
- … at 11 000 years old.

Did you know?
- The world's tallest building will be the Kingdom Tower in Saudi Arabia.
- 1 km tall!
- It will be finished in 2018.

Why…
- … do we build skyscrapers?

Did you know?
- The oldest occupied settlement in the UK is Amesbury in Wiltshire.
- People have been living there for over 10 800 years.

What if…
- … we all lived in cities?

Your chapter starter

Look at the photo on page 30. What does it show?

How did this place get to be like this?

In what ways is it different from your place?

Would you like to live in a place like this? Why … or why not?

In which country do you think this place is? (Hint: 5 letters, last letter is 'n'.)

So you're off then?

How our towns and cities grew

Today, more than half of all humans live in towns and cities.
How did this come about?

Once upon a time

We take towns and cities for granted. But 10 000 years ago, there weren't any!

Hunter gatherers, that's us.

Once upon a time, our ancestors lived by hunting, and eating wild fruit and seeds. So they were always on the move, looking for food.

What are you up to?

It's called planting.

Then about 12 000 years ago, they realized that they didn't have to eat everything straight away. They could store seeds – and even *plant* them.

Come with me.

What for?

It was the start of farming. They began to grow crops, and then to rear animals. Wild sheep were the first animals to be domesticated.

So we moved out of the cave last week.

Super.

DUN ROAMIN

Farming meant they could settle in one place. So over time, clusters of dwellings grew. It was the start of **settlements**.

I'll swop these for them.

Look what I made. They're for feet.

When farmers grew more than they needed, they would swop it.
(Or, after money was invented, sell it.)
So markets developed.

How be yonder town?

There be carpenters, bakers, hat makers, tailors, cobblers …

… and six inns and a church.

Villages grew around markets. Some were in good locations, and grew into **market towns**, where you'd find many non-farming activities.

I be happy here with my scythe.

But for thousands of years, most people continued to live in rural areas, as farmers. They went into town only for fairs.

… so the steam makes the wheel go round.

Ahhh. I see.
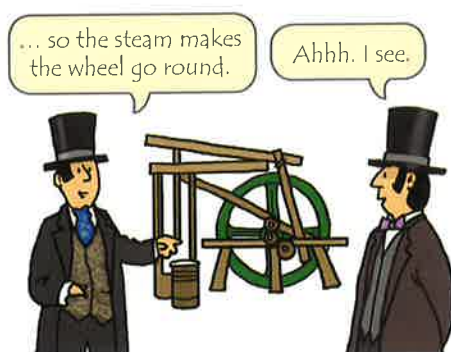
Then came the Industrial Revolution (about 1760 to 1840). It began in the UK. Machines were invented which would change everything.
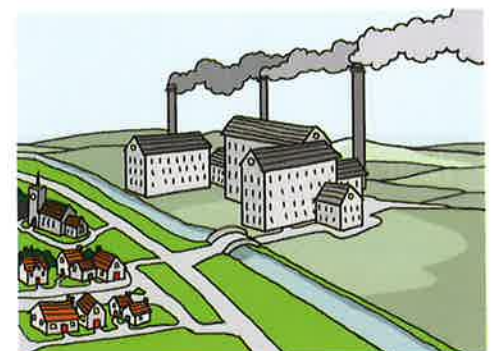
Factories using the machines sprang up – usually in or close to towns, because they needed workers.
At the same time …

...farming was changing. New crops and farming practices meant farms could produce much more food than before – with fewer workers.

So people poured in from rural areas, looking for work in the new factories. The towns exploded in size. Some grew into cities.

Industry spread to other European countries, and the USA. So their towns and cities grew rapidly too. New forms of transport helped.

From around 1950, the growth of towns and cities slowed down in Europe and the USA ... but took off on other continents. Today ...

... it's happening fastest in Africa and Asia. People are pouring into towns and cities from rural areas, as they once did in the UK – but faster.
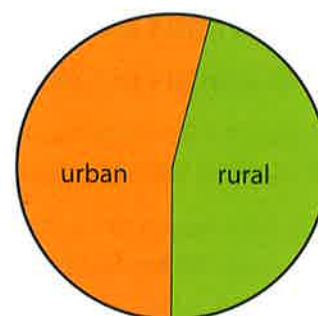
Today about 54% of humans live in **urban** (built-up) areas. By 2050 we think the figure will be 70%. Where will it all end?

It's urbanisation!

So, in countries all over the world, the *percentage* of people living in towns and cities is growing. This change is called **urbanisation**. And look at the numbers:

- 200 years ago, just over 5% of us lived in towns and cities. Or about 52 million people.
- Today, around 54% of us do. And there are far more of us – so that's about 3913 million people.

This represents a *huge* change in how we humans live. You'll find out more about it in the rest of this chapter.

Did you know?
- Even thousands of years ago, the world had some cities ...
- But only small ones ...
- ... because farmers couldn't produce enough extra food to support lots of city dwellers.

Your turn

1 Our ancestors were *hunter gatherers*. What does that mean?

2 Write definitions for these terms from the text:
   a settlement   b market town

3 Changes in farming helped the Industrial Revolution to get going. See if you can explain why.

4 Explain clearly what these terms mean:
   a urban area   b rural area   c urbanisation

5 Might we become 100% urban, one day? Give your reasons.

6 And now ... write a letter to one of your hunter-gatherer ancestors, describing the big changes in the way we live, since he or she was around. *At least* 50 words!

Manchester's story – part 1

In this unit and the next, we take Manchester as our example for urbanisation in the UK.

Manchester's early history

Manchester began with the Romans! Around 79 AD, they built a fort near a crossing point on the River Medlock. They called it *Mamucium*.

A settlement grew up around the fort. When the Romans left, it remained. And by the 13th century, Manchester had become a market town.

Then in the 14th century, some Flemish weavers settled in Manchester. It was the start of a tradition of making wool and linen cloth. People did the spinning and weaving in their homes.

The cotton mills arrive

By 1760, Manchester's population was about 17 000. Then two things happened:

- The Industrial Revolution came along. And many of the new machines that were invented were for spinning and weaving fibres to make cloth.
- Cotton fibre began to be imported into Liverpool, which was connected by river to Manchester. So cotton could be brought to Manchester by boat.

Manchester, with its cloth-workers, was an ideal place for cotton mills. They sprang up everywhere. So did factories for dyeing and printing the cloth, and making mill machinery. Later, many other industries would join them.

Population explosion

People poured in from the rural areas around Manchester to work in the mills and factories. They came from other parts of Britain too. And later, many would arrive from Ireland, when it was in the grip of a terrible famine.

So the population grew and grew. In 1853, with its population over 300 000, Manchester became a city.

▲ This was once a cotton warehouse. The merchant was doing well! It opened in 1856. Today it's an hotel.

▼ This painting shows Manchester in 1857.
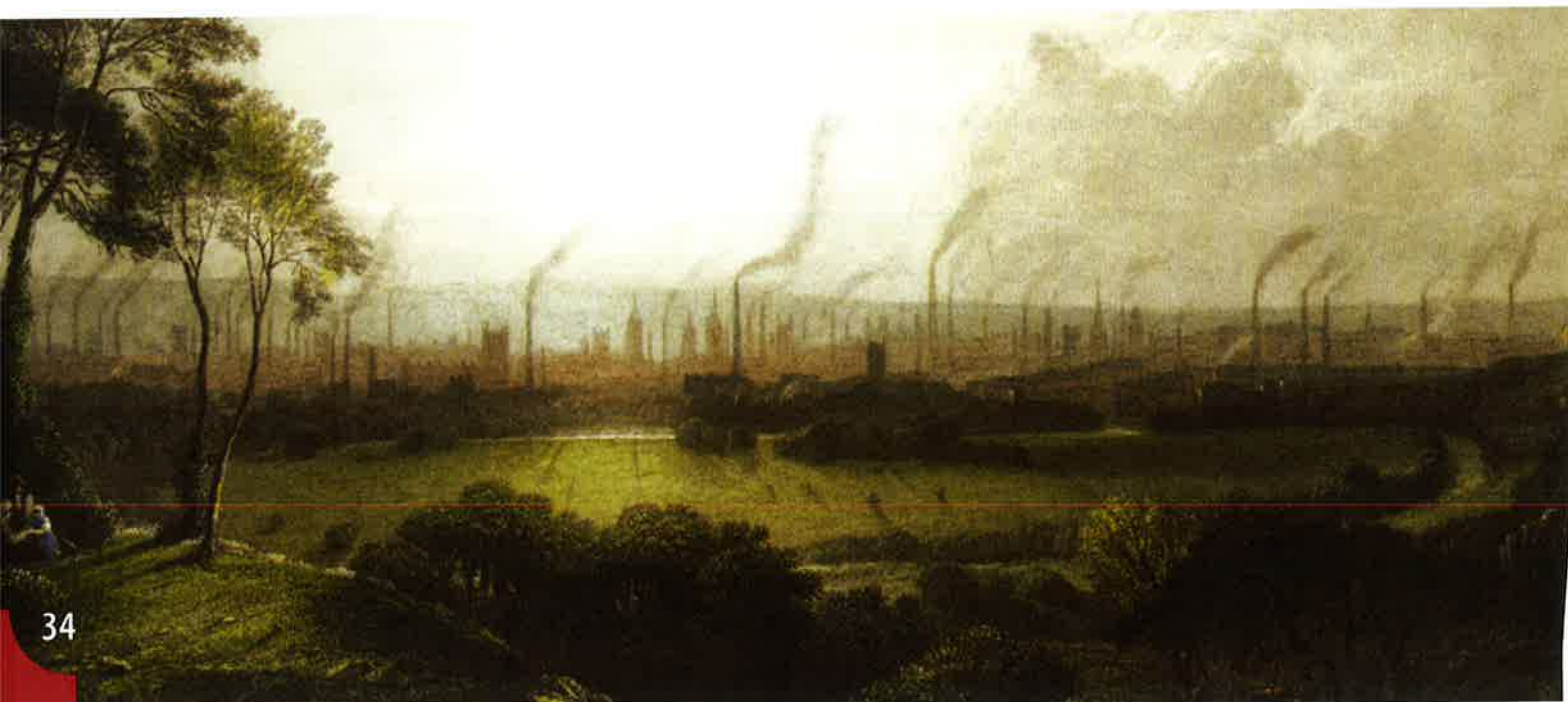
What about the workers?

Life was not so great for the workers.

Speculators built cheap houses to rent to them, close to the mills and factories.

Most were in terraces, crammed into narrow streets. Most had only two rooms – one up, one down. They had no running water. People shared outdoor privies (toilets) with dozens of others.

Taller housing was built in courtyards off Manchester's main streets. These buildings were called **tenements**. People would be packed in everywhere, including the cellars.

▲ Housing for the workers. Many terraces were back-to-back: the houses were joined to each other on three sides.

Slums

Over time, the areas of workers' housing became **slums**. Soot and fumes from the factories polluted the air. Smelly slimy rubbish lay everywhere. Disease was rife. Over half of the children born in the slums would die before age five.

From 1848 onwards, laws were passed to force landlords to make improvements.

Manchester spreads outwards

Meanwhile the factory owners, and merchants, and speculators, and bankers, grew wealthy. As the city became more crowded, they moved out to its edges, into large and comfortable homes. So Manchester spread further and further.

Manchester was not alone

Manchester was not the only place in the UK to change like this. London, Liverpool, Birmingham, Glasgow, and several other cities also grew fast – and developed slums – as industries flourished.

▶ If you had lived in Manchester in the 19th century, you might have worked in a mill. Around 20% of the workers were under 14.

Your turn

1 Where is Manchester? Describe its location as clearly as you can. Page 139 may help.

2 Manchester became the world's top city for cotton weaving. They called it *Cottonopolis*. See if you can pick out:
   a one geographical factor   b one social factor
   which helped to make it a success.

3 It is 1857. You are a journalist from Canada, visiting Manchester. Write a report for your newspaper, giving your first impressions of the city. Try for at least 40 words.

4 a What are *speculators*? (Glossary?)
   b Why did they build such small houses?
   c What are *slums*?
   d The slums were horrible. So why didn't people just leave, and go back to the rural areas?

5 This unit describes the *urbanisation* of Manchester.
   a Why did the urbanisation take place?
   b Who do you think gained *most* from it? Give reasons.
   c Do you think anyone lost out completely? If yes, who?

Manchester's changing population

This graph shows how Manchester's population changed. Look at its shape.

a   It's 1801. The Industrial Revolution is underway. Manchester's population is around 70 000.

b   See how the line rises steeply as people flood into Manchester. And new babies add to the urban population.

c   Growth peaks at around 1931. At this point, the population is around 766 000.

d   Shock, horror. The population is falling !

e   It is 2001. The population has shrunk to about 393 000. Help !

f   Up we go again. Phew !
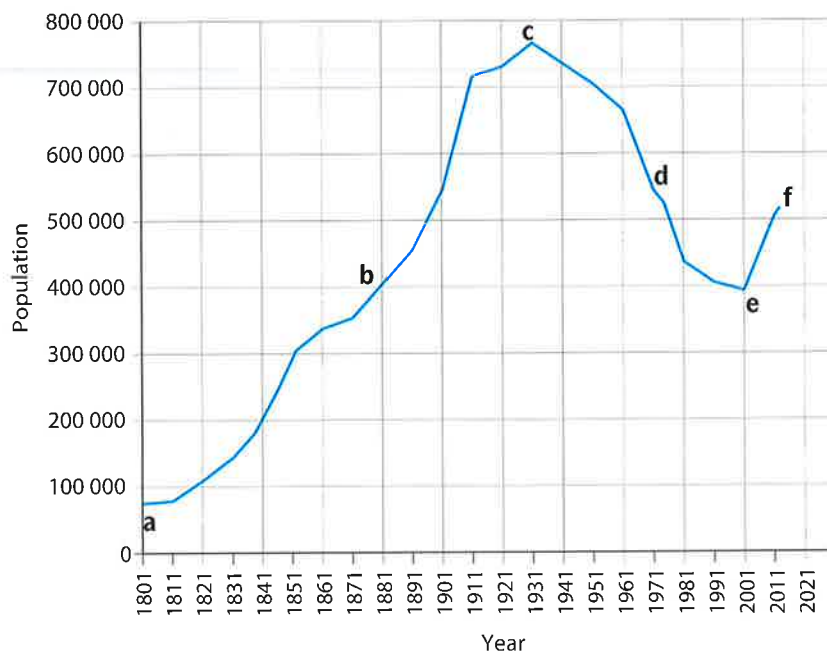
Why did the population fall ?
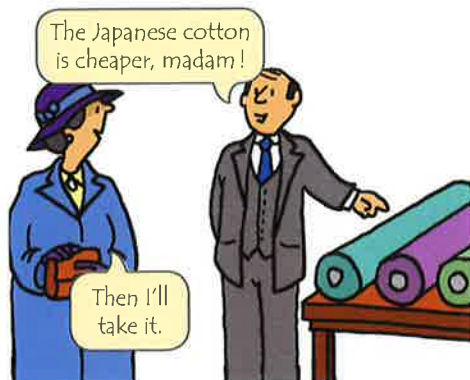
Manchester sold cloth and other goods all over the world. But other countries began to make the same things, and sell them more cheaply.

So Manchester's factories could not compete. They shut down one by one. People lost their jobs. Morale was low. Crime rates rose.

People had to move to other towns and cities to find work. Often they were the people with most skills. Some even emigrated.

The other industrial cities in the UK suffered in just the same way.

Why is the population rising again ?

Hard work was needed, to help Manchester recover from its **decline**.

Most of its industry had gone for good. So the city leaders had to find ways to **regenerate** the city. The notes on photo **B** tell you about the changes that began around 30 years ago, and are still going on.

Did you know ?
- Manchester United FC was formed in 1878 by railway workers.

Manchester is being promoted as a great place for sport. Its famous football clubs help. Spot the football stadium!

It has a growing reputation for music and culture too.

It now has lots of entertainment, and places to eat.

Run-down housing has been replaced by modern housing.

It has the UK's second biggest shopping centre: Trafford Centre.

The canal – which once brought coal for the factories – has been cleaned up. Many trees have been planted..

It now has many thousands of businesses providing services, including internet services.

The old industrial park, Trafford Park, has been cleared to make way for new businesses.

It now has a modern city tram service, great road and rail links to other cities, and the UK's third biggest airport.

Today, as you saw from the graph, Manchester's population is growing again.

What about the rest of the UK?

As you saw in the last unit, other cities across the UK grew too, as industries developed. They declined as factories closed. And like Manchester, they have had to work hard to regenerate themselves.

Today, towns and cities in the UK are still growing – but far more slowly than 100 years ago. Around 80% of people in the UK now live in urban areas.

Did you know?

• Manchester City FC was started in 1880 by a church, to give local people something to do.

Your turn

1 The graph shows how the population of Manchester changed between 1801 and 2011. Describe how it changed over that period, in less than 30 words.

2 Manchester started to decline around 1931.
   a What does *decline* mean?
   b Why did the city decline?

3 The fall in population from 1931 left Manchester less crowded. But it worried the city leaders. Try to explain why.

4 To help regenerate the city, the city leaders promoted sport.
   a What does *regenerate* mean?
   b Try to explain how a sport like football can help to bring money into a city. Give at least two examples.

5 Now, from the notes on the photo above, choose two more ways in which Manchester has changed since the 1980s. Explain how those two changes helped the city.

6 Is the regeneration of Manchester working? Give evidence!

Urbanisation around the world

Most people in the UK live in urban areas. Is it the same in other countries? Find out here.

A map of urbanisation around the world

In Unit 3.3 you saw that 80% of people in the UK live in urban areas.

What about the rest of the world? Look at map **A** and its colour key. The deeper the shade, the higher the % in urban areas.

Did you know?
- North America is the most urbanised continent, at 82%.
- Next is South America (80%).

A

Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
Antarctic Circle

Key

urban population
- over 80%
- 60–80%
- 40–60%
- 20–40%
- under 20%
- no data

cities
- ■ over 10 million
- ▣ 5–10 million
- ▢ 1–5 million
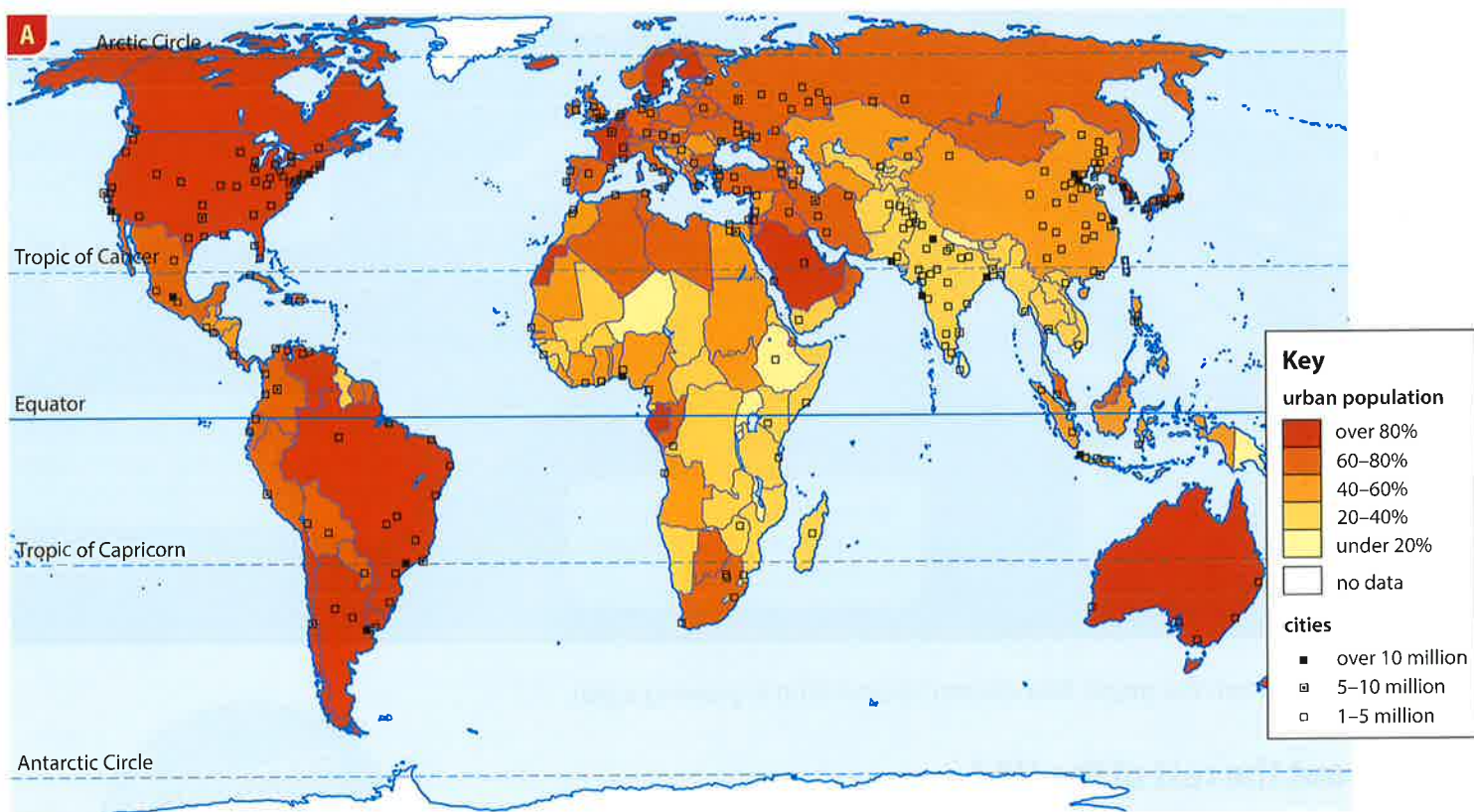
Some cities are marked on the map too: the ones with at least 1 million people. Look for the cities with over 10 million people. Some of these have far more than 10 million. For example Shanghai, in China, has over 24 million people.

Most cities are smaller

Map **A** shows only the cities with at least 1 million people.

In fact more than half of the world's urban dwellers live in towns and cities *with fewer than 500 000 people*. These are not shown on the map because it would be too crowded.

In the UK, only two cities have over 1 million people (Birmingham, 1.07 million and London, 8.31 million). And only one has over 5 million people (London).

▶ *As more and more people move in, cities spread outwards – and upwards.*

What about the future ?

Map **A** is for the world today. But in 2050 it will look different. Why ? Because …

- All over the world, every year, millions of people are still moving from rural areas into urban areas.
- At the same time, lots of new babies are being born in the urban areas.
- Today, around 54 % of the world's population lives in urban areas. It is likely to be 70 % by 2050.
- The % of the population that's urban is lower in Africa and Asia than in the other continents. But it is rising fast.
- By 2050, most of the world's new babies will be born in cities in developing countries.
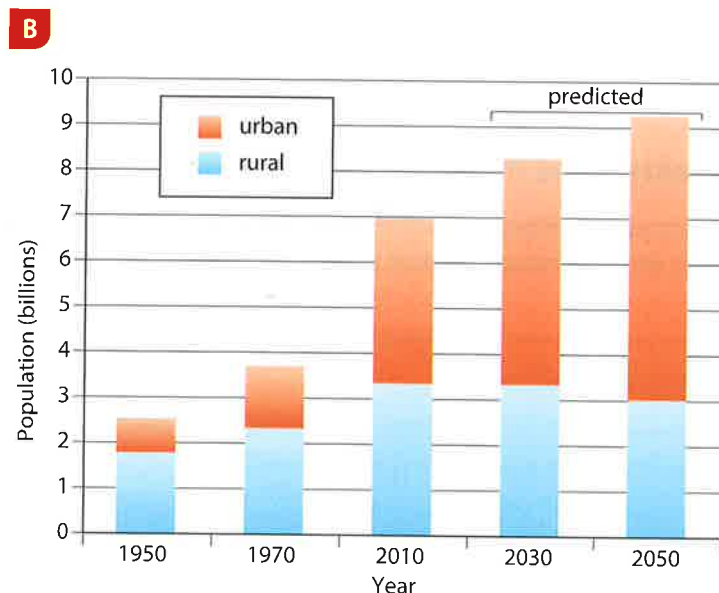
Is urbanisation a good thing ?

For many people, cities are brilliant. Lots of friends, exciting things to do, and types of work you won't get in rural areas.

But for many city dwellers around the world, life is not so great. Many live in poverty, and in appalling conditions.

Find out more about the pros and cons of urbanisation in later units.

Did you know ?
- Singapore – a very small country in Asia – is 100 % urbanised.

B

Bar chart B: Population (billions) vs Year (1950, 1970, 2010, 2030, 2050), showing urban and rural. 2030 and 2050 marked as predicted.

▲ *Yes, we're enjoying ourselves.*

Your turn

1 Look at map **A**.
  a Which continent has the lowest % urbanisation?
  b Name a large country in South America where at least 80 % of the population lives in urban areas.
  c Name a country where:
    i less than 20 % of the population lives in urban areas
    ii more than 80 % of the population lives in rural areas
  d Write a sentence about the level of urbanisation in Russia.

2 Look at bar chart **B**.
  a About how big was the world's population in 2010?
  b About how big is it predicted to be by 2050?
  c What has happened to the number of people living in urban areas since 1950?
  d In 2050 will there be more people in rural areas, or fewer, than there were in 2010?

3 Governments like to know what % of their populations are living in rural areas. Suggest a reason for this.

Why do people move to urban areas?

Here you'll think about the reasons why people move from rural to urban areas today.

Making the move

Every year, millions of people leave rural areas, to move to towns and cities. Why do they move? Look at these examples.
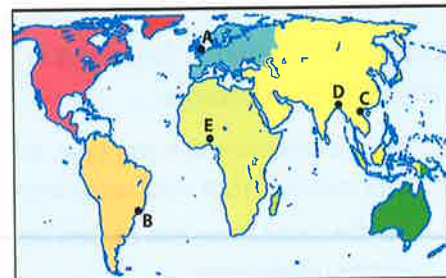
Sylvie, London, UK

I was born in a little village in Yorkshire. It's lovely – but so quiet! It was a long bus ride to school.

Then I went to art college in London. And that's where I live now. I'm a fashion designer.

I love going back home to visit. It's so peaceful. But I could not live there. I'd be bored! Anyway, London is the place to be, for a career in fashion. I have lots of contacts here.

Three friends, Rio de Janeiro, Brazil

We've been friends since we were little. We grew up in the same village. We used to talk about going to Rio, and earning loads and watching football.

We've been here for six years now. Not earning loads, but life is good. Joel (on the right) is married. Viktor (middle) saved like crazy to go to college. I work for a tour company. It's okay, Rio gets lots of tourists.

Life in the city has hassles – but it's more fun than the countryside. Give me the city any day.

Lan, Hanoi, Vietnam

I'm from the country. I do miss my village – but my family were so poor. I had no option but to leave.

I like the city. I like making snacks, and business is good on this street. I always send money home. My parents are quite old now and they depend on me.

I am getting married to Huy soon. He's from my village too, and he's a taxi driver. We'll never be able to buy a flat – but we'll be okay.

Shimaz, Dhaka, Bangladesh

I'm 19. I came to Dhaka two years ago to help my family, because they are very poor. I work in this factory 6 days a week, making clothing for shops in the UK.

I make $20 a day (about £11.50) and send half home to mum. I'm really glad I can do this.

Life is not easy here – but I do like having freedom, and my own money. Back in my village, I'd be married by now.

I have good friends in the factory. We share a dorm. On our day off we go around the market.

Osakwe and his family, Lisa, Nigeria

We're moving to Lagos next week, the whole family.

I've tried to make a go of the farm. But we had floods the last few years, and everything rotted. It's hopeless. They say it's climate change.

I want my children to have a better life. I don't want them to be farmers. The schools here are no good. I think Lagos will be better.

My brother lives there, and says we can stay with him till we get on our feet. I don't want to be a burden to him. I'm sure I'll find something to do.

Push and pull factors

People may feel forced to move from rural areas, for example by poverty. Factors that drive you away are called **push factors**.

But some places attract people because they offer a lot of advantages. For example, well-paid work, or a chance for education. Factors like these are called **pull factors**.

I feel pushed. | I feel pulled.

Your turn

1. What is: **a** a push factor **b** a pull factor?
2. **a** Make a big table with headings like this:

Names	Push factors	Pull factors

   b Now fill it in for the five photos in this unit. See how many push and pull factors you can identify.

   c Compare your table with your partner's. Did you both come up with the same factors?

3. Choose three *different* push factors for the people in this unit. See if you can put them in order, strongest one first.

4. Some people move the other way. For example, a high crime rate might drive them from the city. See if you can think of:

   a three other *push* factors that might drive people from a city to a rural area

   b three *pull* factors that might attract people from the city to a rural area

3.6 It's not all sunshine!

Life in urban areas brings many benefits. But there are problems too. Find out more here.

Do we like towns and cities?

Yes! We humans do like towns and cities. Over half of the world's population live in urban areas.

Here are some benefits of living in urban areas.

Benefits of living in urban areas

- concerts, clubs, cinemas, fun
- lots of interesting things to do
- lots of people who share your interests
- colleges, universities, all kinds of classes
- good shops
- airports
- all kinds of eating places
- all kinds of work
- well paid jobs
- hospitals and other health services
- frequent buses, trams, trains

But there are disadvantages too. Look:

Disadvantages of living in urban areas

- pollution
- crime
- anti-social behaviour
- competition for jobs
- competition for housing
- crowds
- concrete everywhere
- struggling through traffic to get to work
- noise
- people don't know their next-door neighbours
- many people feel isolated
- more expensive than living in rural areas

Making towns and cities more sustainable

Something is **sustainable** if it will benefit us socially and economically, into the future, and not harm the environment.

We can make towns and cities more sustainable – more pleasant to live in, with less pollution, less energy waste, and less hassle. Here are some ways:

- **build energy-efficient homes** that need little or no heating in winter and are cool in summer – and make them cheap to buy or rent!
- **cut car use** by having brilliant public transport with low ticket prices; and cycle tracks; and safe and pleasant walkways
- **reduce travel times** build homes closer to workplaces, and vice versa
- **go greener** more trees, parks, green roofs
- **provide more for young people to do** a place where you can follow your interest, whatever it is (acting, music, carpentry, programming …)

▲ *Do you think this skate park counts as sustainable development?*

▲ *From 2018, all new London taxis must be able to use hydrogen as fuel. The only waste it produces is water.*

▲ *Green roofs (roofs with plants) soak up carbon dioxide. Some plants can remove other harmful gases too.*

Your turn

1 Look at the benefits of living in urban areas, on page 42.
   a Which three benefits appeal to you most?
     Write them in order, the most appealing first.
   b Would they be strong enough to pull you into, or keep you in, a city?

2 Now look at the disadvantages.
   a Pick out the three that would be the most likely to put you off the city.
   b Would they stop you living in the city?

3 a Imagine you are an elderly retired person. Choose the three push factors most likely to drive you from the city.
   b Is your answer the same as for question **2a**?

4 What does *sustainable* mean?

5 How does planting green roofs help to make a city more sustainable? (There may be several answers!)

6 What changes would make the place *you* live in more sustainable? See what ideas you can come up with. (No silly ones!)

Life in the slums

Life in the city can be difficult. If you live in a slum, it's even more difficult. Find out more about slums here.

Don't forget …

Even 100 years ago, the UK had some appalling slums. You read about Manchester's on page 35. Today, many cities around the world have slums.

Over 860 million people live in slums

Today, cities are growing fastest in developing countries. The people who flock to them are mostly poor. So they end up living in slums.

In some slum areas, the housing was once okay. But it has been neglected for so long that it is in really poor condition.

Other slums are made up of shacks which people built for themselves, using any materials they could find. The shacks have no running water or toilets. These slums are usually called **shanty towns**.

In fact *about one-third* of the urban population in developing countries is living in slums. That's over 860 million people. A great many of them are children.

▲ *Life goes on in Kibera, a large slum in Nairobi in Kenya.*

Osakwe in Lagos

Lagos is Africa's largest city. Around two-thirds of its people live in slums. On page 41 you met Osakwe, who was heading there. What did he find?

My first week in Lagos

Here we are in Lagos. In Agege, a slum, with my brother Amadi. Never have I seen so many shacks!

There are nine of us in his two rooms, so it's crowded. But we have electricity! We didn't have it in my village. It's on for a few hours, most days. You never know when it will go off.

There's a water tap a few minutes away. The nearest latrine is down the track. It's a hole in the ground behind a bamboo screen. There is always a queue.

And the rubbish! People just throw rotting stuff into the gully in the lane. There are flies and dogs everywhere. I'm worried the children will fall ill. I can't afford a doctor.

Amadi is a porter in the market. Eki – his wife – has a food stall. They work so hard. He thinks I should try the market too. I must find something soon, and a place of our own to live in.

I must forget about school for the children for now. I am sad about that. I hope life will be better for us here … but I'm not sure it will.

▲ *Osakwe's first view of the slum.*

Tackling the slum problem

Around the world, city councils are working hard to tackle the slum problem. There are different approaches:

* **new housing** In some places they build blocks of new flats, and move people into them at low rents, and clear the old shacks away.

* **self-help** In some places, they give people building materials, and some training. Then people build their own, improved, homes.

* **better services** In some places they leave the housing in place, but provide reliable water and electricity supplies, and a sewage system, and rubbish collection. Those make life so much much better.

But it all costs money. And every day, more people arrive. The city councils don't have much money. So it's a non-stop struggle.

It will take many years to solve the world's slum problem.

▲ *New low-rent flats for the slum dwellers of Kibera.*

▲ *New shacks for slum dwellers in South Africa. The roofs have solar panels, to give electricity. The walls are packed with materials to keep the inside cool. Rain is collected from the sloping roof.*

▶ *A cable car system to help shanty-town dwellers in Medellin, Colombia. It gives easy and cheap access to the city, where there's work.*

Your turn

1 Remind me. What's a *slum*? Write down your answer.

2 Osakwe is now in Lagos, and not too happy.
   a List the problems which he faces at this point.
   b What do you think would improve his situation most?

3 Compare photos **A**, **B** and **E** with the photo of Manchester on page 35.
   a What similarities, if any, can you see?
   b What are the differences? (Don't forget factories!)

4 Draw a sketch of the building shown in photo **A**. Then add labels to say:
   a what it is made of   b what size you think it is
   c what might be inside   d what's probably not inside

5 What are: a shanty towns?   b favelas?

6 Look at photos **C**, **D** and **E.** They show some ways to improve the lives of slum dwellers. Which improvement appeals to you most? Explain your choice.

A city of the future?

What if you could build a brand new sustainable city?
It is happening in Abu Dhabi. Find out more here.

Starting from scratch

Suppose you could start from scratch, and build a new and sustainable city. That is what's happening in Abu Dhabi.

Abu Dhabi is part of the country called the **United Arab Emirates**, or **UAE**. It is wealthy, thanks to oil. But now it is thinking about the future, when oil may run out.

In 2006 it decided to build the world's most sustainable city. It is called Masdar City. Part of it is open already. It will be finished by 2025.

Masdar City: the challenges

Masdar City is in a hot, dry, and sunny place – the desert! Its aims are to:

- **say no to fossil fuels**   and instead use solar power for electricity
- **keep cool**   by planning streets and buildings to create shade, and breezes
- **be walkable**   with everything close by: homes, work, shops, entertainment
- **allow high population density**   with buildings close together – but not usually more than five storeys tall
- **have car-free streets**   by providing slick electric public transport
- **minimise waste**   for example by recycling waste water to water the trees and other plants. (The water for this city in the desert is obtained by **desalinating** sea water.)

A place to learn from

Masdar is just a small city. It plans to have 40 000 residents, and 50 000 others commuting there to work.

But it aims to have a big impact on the world. At the Masdar Institute, world-class research is going on into ways to make cities more sustainable. One day, its findings may improve a city near you!

What if...
- ... you had your own electric pod for getting to school?

Did you know?
- One day, you may have a robot to cook and clean and iron for you.

Your turn

1 Masdar City is 11 miles from Abu Dhabi city. Where is Abu Dhabi city? Give its full address, including the continent!

2 Look at the aims of Masdar City.
 a First, write them out in what you think is their order of importance. (Just the bold words.)
 b Then give reasons for your first choice.

3 Suggest a reason why Masdar City …
 a has banned taps and light switches
 b wants its streets to be car-free

4 *Masdar City runs on* solar power. *Unlike oil, solar power is a* renewable resource. *The drinking water is obtained from sea water by* desalination. Explain the three terms in blue.

5 Which ideas from Masdar City do you think …
 a could easily be copied in cities in the UK?
 b are not really needed in the UK? Why not?
 c would be too hard to use in our cities? Why?

6 Which feature of Masdar City appeals to you most? Why?

7 Would you like to live in a city like Masdar City? Give reasons.

▲ Solar panels provide the electricity for the city.

▲ There are no taps or light switches. Sensors detect when you want to use water, or enter a dark room.

▲ Masdar City aims to be car-free at street level. They tried out these driverless electric pods for travelling under the city.

▲ At the Masdar Institute, people research ways to make cities more sustainable.

▲ The city is on a platform, so that cool breezes can flow below it. Everything is close by, to encourage walking and cycling. There are no cars on the streets.

▼ Streets are narrow, for shade, and laid out to create cooling breezes. So it feels at least 15 °C cooler here than outside the city.

▼ Public spaces are pleasant to walk in, with trees and other plants. These white 'sunflowers' provide shade – and capture solar energy.

47

A

▲ Stoer, Scotland.

B

▲ Morston Marshes, Norfolk.

C

▲ Sennen Beach, Cornwall.

D

▲ Handfast Point, Dorset .

X

The big picture

This chapter is all about the **coast**, where the land meets the sea.
Here's the big picture …

- The coast is shaped and changed by the waves – and by humans.
- The waves shape it by eroding, transporting, and depositing material. This gives special landforms.
- We humans change it by building on it, and using it in other ways.
- Places along the coast are at risk from flooding and erosion by the sea. With climate change, this will become a bigger problem.
- There are ways to protect places from the sea. But they cost a lot.
- In future, some parts of the coast will not be protected. We will let the sea drown them.

Your goals for this chapter

By the end of this chapter you should be able to answer these questions:

- What causes waves?
- How do waves shape the coast?
- What do these terms mean?
  erode   transport   deposit   longshore drift
- What are these, and how are they formed?
  beach   bay   headland   cave   arch   stack   stump
  wave-cut platform   spit   salt marsh
- How do we use the land along the coast? Give at least five examples.
- What is a *storm surge*?
- Why is the coastline eroding fast, in some parts of the UK?
- What kinds of structures do we build, to protect land and homes from the sea? Name at least four.
- What are the government's plans for coastal defences?

And then …

When you finish the chapter, come back here and see if you have met your goals!

Did you know?
- Part of our south coast is called the Jurassic coast …
- … because dinosaur fossils are found there.

Did you know?
- The UK's coastline is about 17 820 km long.
- It's very long because it's very wiggly!

Why…
- … does Britain have a coast?

What if…
- … Britain had no coast?

Did you know?
- 8 of the world's 10 largest cities are on the coast.

Why…
- … do we like to be beside the sea?

Your chapter starter

Look at the photos on page 48. They show four places on our coast.

What's the coast?

What can you do there?

How far do *you* live from the coast?

Why does it look so different in those four places?

Has anyone seen my flippers?

Waves and tides

At the seaside you'll notice the waves, and the tides.
Find out about them here.

What causes waves?

Waves are caused by the **wind** dragging on the surface of the water.
The length of water the wind blows over is called its **fetch**.

◆ the **stronger** the wind is, and
◆ the **longer** it blows for, and
◆ the **longer** the fetch …
the **larger** the waves will be and the more energy they'll have!

Nice day!

the fetch

Help!
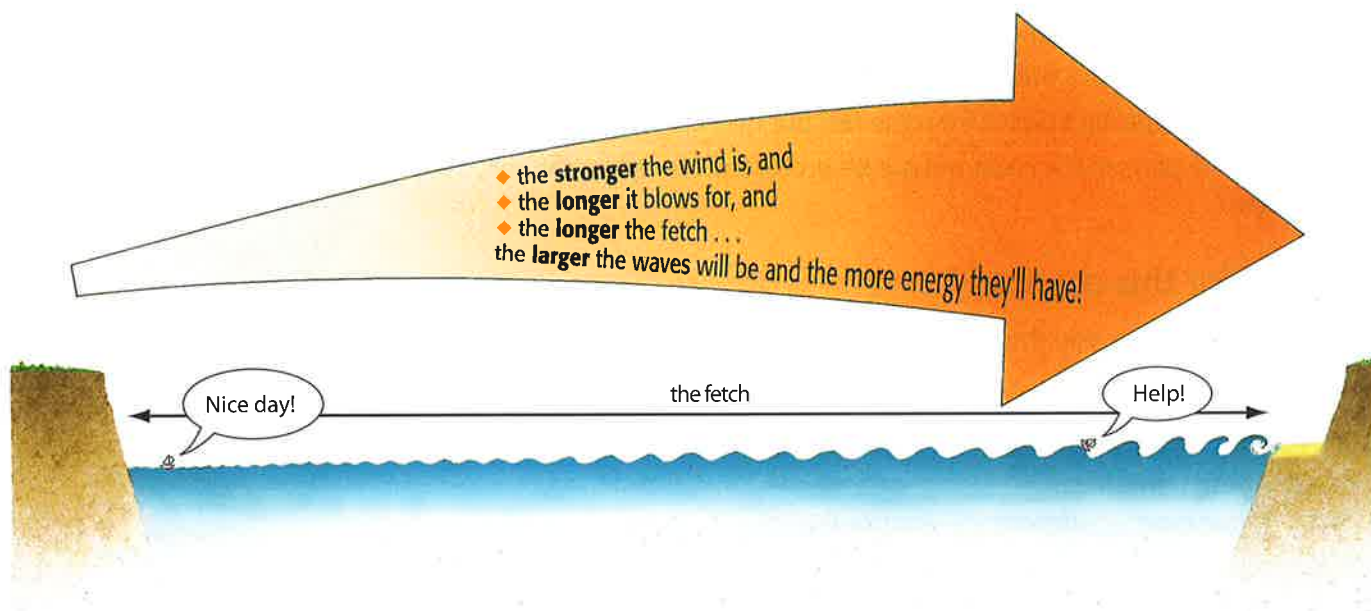
When waves reach the coast

Swash this then?
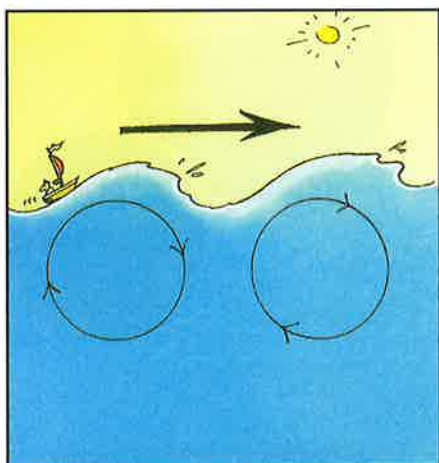
Backwash!

Out at sea, the waves roll like this.
In a gale they can be over 30 m
high! But at the shore they break …

… giving turbulent water called
swash. The water rushing up the
sand is called the **uprush**.

The water rolling back into the sea
is called the **backwash**.
Shortly, another wave will arrive.

If the backwash has more energy than the uprush, the waves eat at the land,
dragging pebbles and sand away. (This happens with high steep waves.)

But if the uprush has more energy than the backwash, material is carried
onto the land and left there. (This happens with low flat waves.)
The material builds up to make a beach.

Tides

Even when the sea is calm and flat, the water level is always changing. That's mainly because of the moon. As the moon travels around Earth, it attracts the sea and pulls it upwards. The Sun helps too – but it is much further away, so its pull is not so strong.

The rise and fall of the sea gives us the **tides**. Look at these photos:

Did you know?
◆ The Bristol Channel has the 2nd largest tidal range in the world …

Thursday 17 May, at noon. The tide is **out**, here at Porthcawl in Wales. In fact the sea has reached its lowest level for today. This is called **low tide**.

Same place, same day, 8 pm. Now the tide is **in**. The water has covered the beach. The sea has reached its highest level for the day. This is called **high tide**.

High tides occur about every twelve and a half hours, with low tides in between. The drop in sea level from high to low tide is called the **tidal range**. It changes through the year, because the pull on the sea changes as the moon orbits Earth, and Earth orbits the Sun.

Your turn

1 Three factors determine how high the waves in a place will be. Write one sentence for each factor.

2 The arrows are winds blowing onto island X.

Key
→ strong wind
← light wind
10 how long it has been blowing (hours)
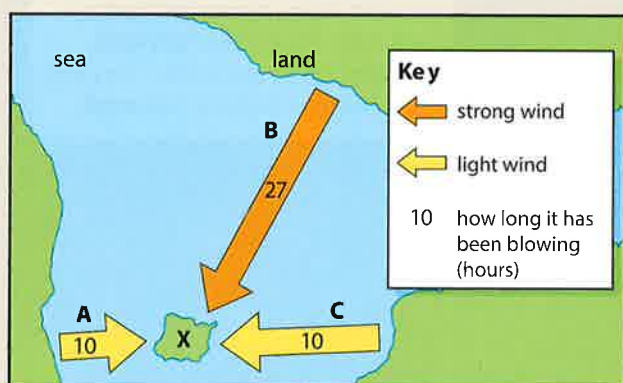
Which wind will produce:
a the largest waves   b the smallest waves
at the coast of X? Explain your answers.

3 Now think about the waves around your own island.
a The *prevailing wind* in the UK is a *south west wind*. What do the terms in italics mean? (Glossary?)

b Explain why the south west tip of England gets some really high waves. (Check pages 140–141.)

c Most of the UK's surfing schools are in south west England, and Wales. Why?

4 Using a full sentence, explain what these terms mean:
a swash   b uprush   c backwash

5 Look at the photos on page 48.
a Which is stronger in photo **C** – uprush or backwash? What is your evidence?
b Which of the four places probably gets hardly any waves? How did you decide?

6 a What are tides, and why do they occur?
b Photo **B** on page 48 was taken at low tide. How would the scene look different, at high tide?
c Now repeat **b** for photo **C**.
d Look at photo **D**. Was this taken at high tide? How can you tell?

7 Now look at photo **A** on page 48. You are on holiday in Scotland. Two days ago you were scrambling around on the rocks – and got trapped at **X** by high tide ! Write an entry for your diary about the event, and how you were saved.

The waves at work

Here you will learn how waves shape the coastline.

What do the waves do ?

Waves work non-stop, night and day, year after year, shaping the coastline. This shows what they do.

3 They drop or **deposit** it in sheltered areas where they lose energy.

1 They wear away or **erode** the coast. These cliffs are being eroded. (Some of the rock has already been weathered – broken down by weather and plants.)

2 They carry away or **transport** the eroded material.
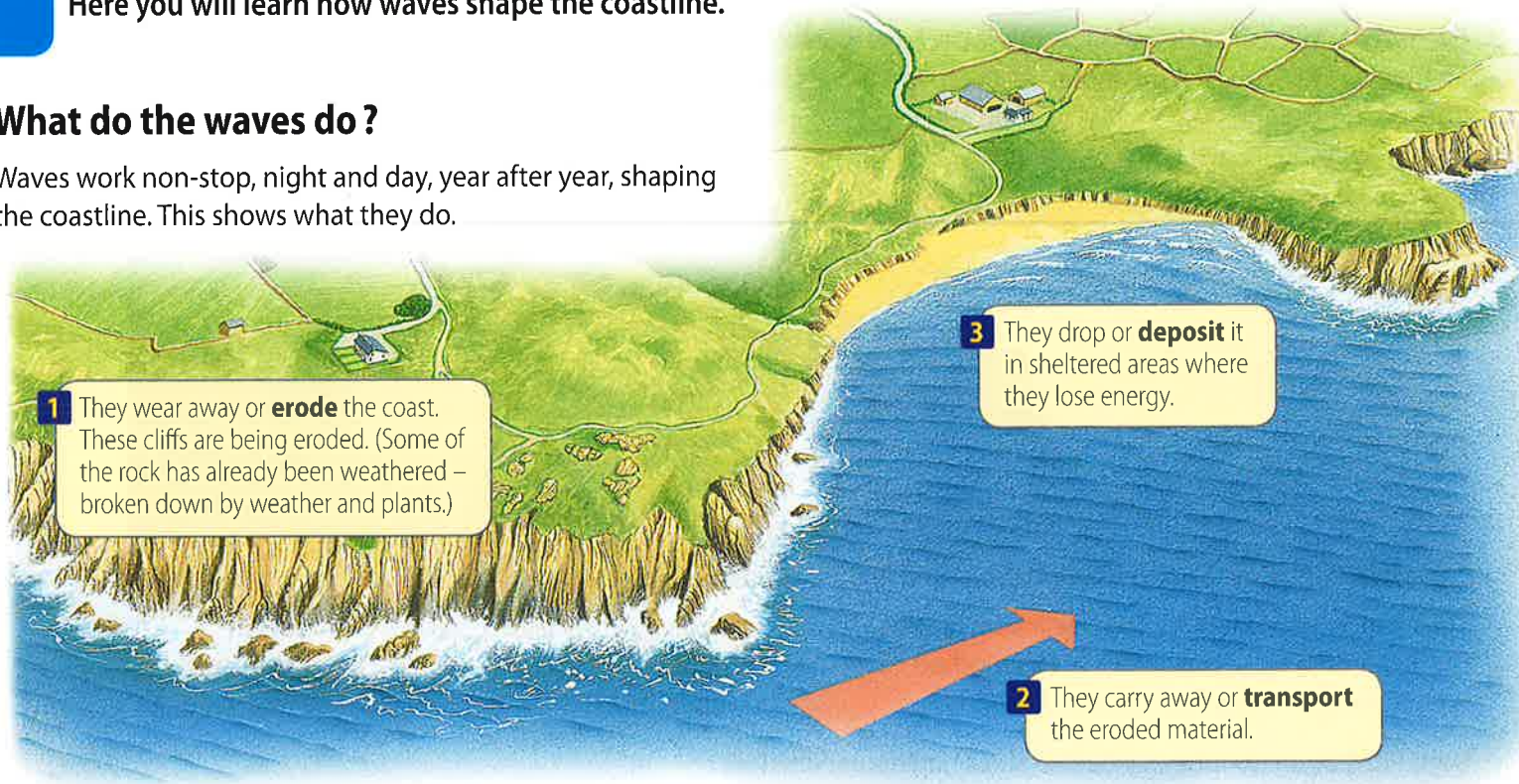
Now we will look at each of these in more detail.

Erosion

This is how waves wear away the coast:

They pound at the rock like a hammer. Over time, this breaks the rock up.

The bits of rock that break off also get worn down, by knocking against each other. This is called **attrition**. They get smaller and smaller. They end up as **shingle** (pebbles) and **sand**.

They force water into cracks in the rock. That helps to break it up. It's called **hydraulic action**.

They dissolve soluble material from the rock. This is called **solution**.

They fling sand and pebbles against the rock. These wear it away like sandpaper. This is called **abrasion**.

The more energy the waves have, and the softer the rock, the faster erosion will be.

Transport

The waves carry the eroded material away. Some is carried right out to sea. But a lot is carried along the coastline. Like this …

1 This pebble is carried off the beach …

2 … by the backwash (and gravity) …

3 … then on again by the uprush of the next wave …

4 … off again …

5 … on again …

6 … and so on. Look how far it has moved from A.

wave direction

direction of longshore drift

A
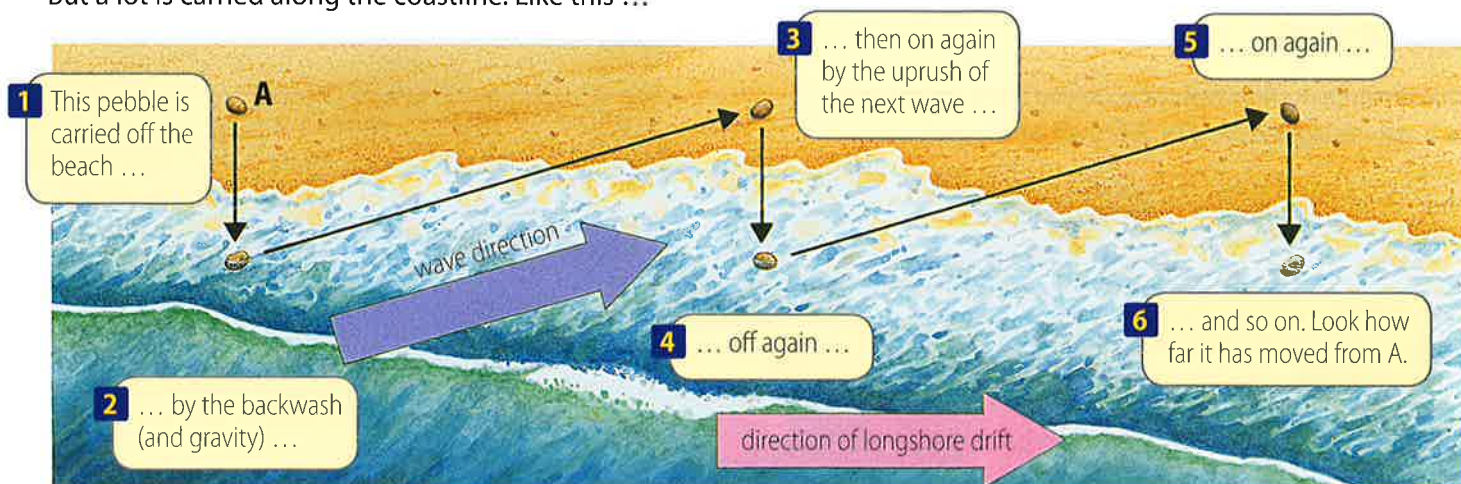
Hundreds of thousands of tonnes of pebbles and sand get moved along our coastline every year, in this way. The process is called **longshore drift**.

Many seaside towns build **groynes** of wood or concrete, to stop their beaches being carried away by longshore drift. Look at this photo.

Deposition

Waves continually carry material on and off the land. If they carry more *on* than *off* – a beach forms!

Beaches form in sheltered areas. Low flat waves carry material up the beach and leave it there. Some beaches are made of sand, and some are **shingle** (small pebbles).

a groyne

N

▲ *The groynes stop the beach being carried away.*

Your turn

1 Waves do three jobs that shape the coastline. Name them.

2 Describe three ways in which waves erode rock.

3 X and Y are two pebbles made from the same rock.
   a Which one has been in the water for longer? Explain.
   b Name the process that made Y so smooth.

X   Y

4 Groynes are barriers of wood or concrete, on a beach. Look at the groynes in the photo above.
   a Why were they built?
   b Are they working? How can you tell?
   c In which direction is the longshore drift heading?
      i   towards the north east
      ii towards the south west
      Give your evidence. (The N arrow will help.)

B   N   A
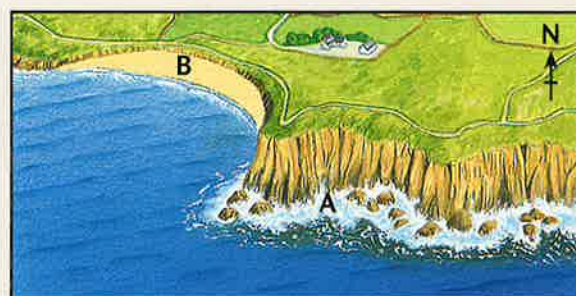
5 This drawing shows part of an island.
   a The *prevailing wind* for the island is blowing. From where does it blow? (Look at the waves!)
   b There is no beach at A. Suggest a reason.
   c There is a good beach at B. Give a reason.
   d Where might the sand at B have come from?

6 Do you think the rock around Britain's coast all erodes at the same rate? What is your evidence?

Landforms created by the waves

This is about the landforms which the waves create along the coast, by eroding and depositing material.

Sculptor at work

This coast is made of different rocks, some hard, some soft. Perhaps it was straight, one day. But look at it now!

1 Hard rock erodes more slowly than soft rock.
So now cliffs of hard rock jut out, forming a **headland.**

3 Here the softer rock has been eroded away, leaving a **bay**.

4 Another headland. Here you can see a **cave**, an **arch** and a **stack**.

cave
arch
stack

2 At the base of these cliffs is a **wave-cut platform**.
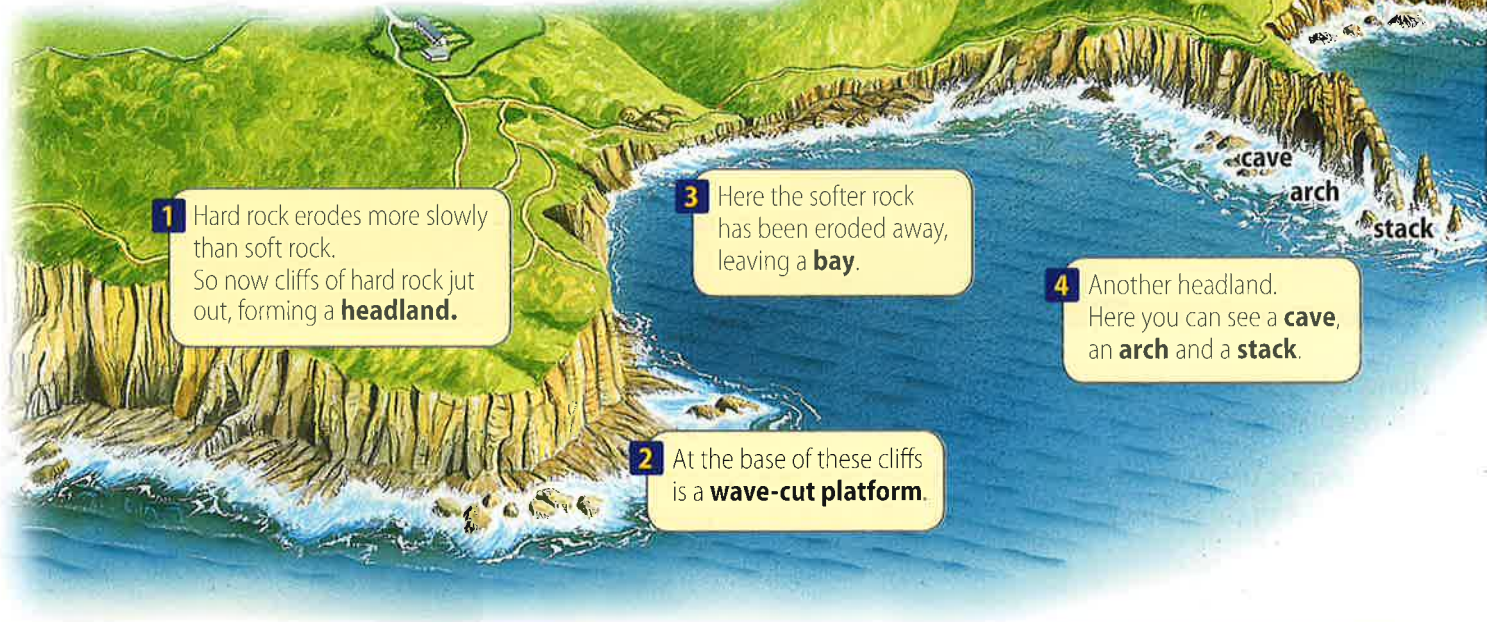
How a wave-cut platform forms

wave-cut notch

wave-cut platform

1 The waves carve **wave-cut notches** into cliffs at a headland. These get deeper and deeper …

2 … until, one day, the rock above them collapses. The sea carries the debris away.

3 The process continues non-stop. Slowly the cliffs retreat, leaving a **wave-cut platform** behind.
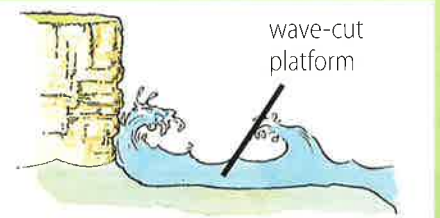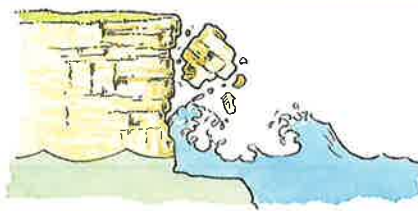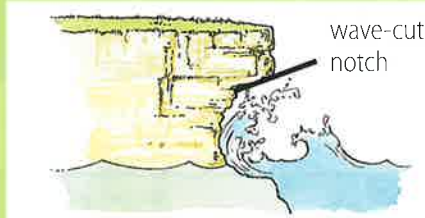
How caves, arches, and stacks form

cave

arch

stack

stump

1 The sea attacks cracks in the cliff at a headland. The cracks grow larger – and form a **cave**.

2 The cave gets eroded all the way through. It turns into an **arch**. Then one day …

3 … the arch collapses, leaving a **stack**. In time, the waves erode the stack to a **stump**.

6 Some is deposited in sheltered areas like this one, forming a **beach**.

7 The coast juts out here, then curves to form a sheltered bay (see **10**). This interrupts the longshore drift …

10 Silt and mud may build up in this sheltered area. It becomes a **salt marsh**.

salt marsh

9 The end of the spit is curved by the waves.

5 Eroded material is carried along the coast by longshore drift.

8 … so sand and shingle are deposited here, in the sea. They build up a **spit**.

spit

Your turn

1

Landform	Created by ...	
---	erosion	deposition
headland	✔	

Make a table like the one started here. Write in the names of all the landforms you met in this unit. Then put a ✔ to show how each was formed.

2 Make a larger sketch of the landforms in photo **A**.
  a On your sketch, label:
    a wave-cut notch   an arch   a stump
  b Explain how the arch was formed.
  c Draw a dotted line to show where there was once another arch.
  d What will happen to the stump over time?

3 Photo **B** shows the spit at Dawlish Warren in Devon.
  a Make a sketch of the spit. Don't forget to show and label the groynes, and salt marsh areas.
  b Now, a challenge. From which direction does the prevailing wind blow, at Dawlish Warren? How did you decide? Mark the direction on your sketch.

4

coast (seen from above)

N

sea

Key
soft rock
hard rock
very hard rock
prevailing wind
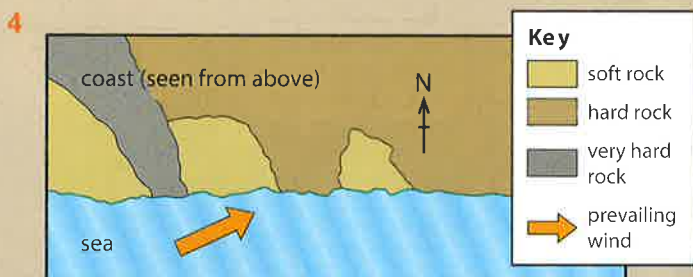
This shows some coast before erosion. Make a larger drawing to show how it may look 10 000 years from now. Label any landforms, and add notes to explain what has happened.

A

B

We use the coast in many different ways. You can find out about them here.

What do we use the coast for?

We live on an island, so there is coast all around us. What do we use it for? Look at the photos.

A

It's great to get away.

B

This used to be a huge industry in the UK.

Not now.

C

Just in from China.

D

Baaa.

E

We need to be in a place where oil tankers can come in.

F

We moved here for the view.

G

We are sailing ...

H

We take sand and gravel from the sea bed, off the coast.

Millions of tonnes a year ...

... for things like road building.
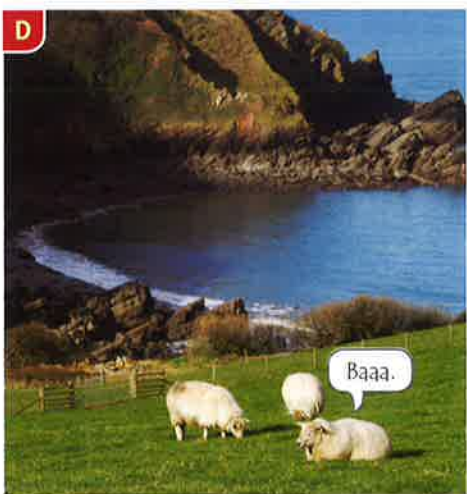
Who owns the coast?

♦ Over half of it belongs to the state (55%).

♦ About 3% belongs to the Ministry of Defence.

♦ The National Trust has bought 1200 km of coastline – in order to give us access to it, and protect it from development. It wants to buy more.

♦ Perhaps 20% is privately owned. For example by farmers. It is hard to get exact figures.

♦ Local councils own the rest.

Did you know?
♦ You can own land along the coast – but not under the sea.
♦ All the sea bed, in the UK's waters, belongs to the state.

Your turn

1

There are lots of settlements along our coast: villages, towns and cities.

a Many early settlers chose to settle on the coast. Why? Give as many reasons as you can.

b Now underline any reasons that you think may still apply, for people living on the coast today.

2 Look at the photos on page 56. They show ways we use the land at the coast, and the sea off it.
You have to match each photo to a term in the box below. But the terms are all jumbled. So you must sort them out first. (Start with the easy ones?)

mesho	deesias storres	fragnim
dustriny	gredding	hisginf
trops	feendec	

Give your answer like this: **A** =

3 Look at the list of the UK's largest cities, on the right.

a Some have ports, which helped them to grow. Which ones? The map on page 139 may help.

b How many other ports can you name, in the UK? Try for at least two.

4 Most of us love the seaside.

a How many seaside resorts can you name, in the UK? Try for at least four.

b A challenge. See if you can draw a sketch map of the British Isles, *from your mental map*, and mark on it the seaside resorts you named in **a**!

5 Look again at the photos on page 56. They are all linked to jobs. For example at seaside resorts, the restaurants and hotels need lots of staff. Which photos are linked to jobs in:

a the primary sector of the economy?
b the secondary sector?
c the tertiary sector?
Explain your choices. (Glossary?)

6 Now see if you can name at least five jobs that people can do at the coast or at sea, but not inland.

7 The UK is one of the world's richest countries (even if it does not seem rich to you). Its coast has helped to make it rich. See if you can explain how.
(Think about what you learned in history?)

8 Are there any *disadvantages* in having a coastline? See if you can come up with some. Answer in any way you choose. (Spider map? drawings? bullet points?)

9 So, would you like to live on the coast? Yes or no? Explain why.
(Or, if you live on the coast already, say how you feel about living there, and why.)

The UK's 10 largest cities		
	Name	**Population (millions)**
1	London	8.31
2	Birmingham	1.07
3	Leeds	0.75
4	Glasgow	0.60
5	Sheffield	0.55
6	Bradford	0.52
7	Manchester	0.51
8	Edinburgh	0.50
9	Liverpool	0.47
10	Bristol	0.43

Your holiday in Newquay

In this unit you'll find out about Newquay, in Cornwall – with the help of an OS map.

Meet Newquay

The OS map on the next page shows Newquay, on the coast of Cornwall. 400 years ago, it was just a small fishing village. Now it's a seaside resort – and a surfers' paradise.

Newquay has about 20 000 full-time residents – and about five times as many people in the summer. You are about to join them for a holiday.

Did you know?
- So far, the highest wave ever surfed was 24.3 m ...
- ... off the coast of Portugal.

Your turn

1 Look at the OS map and photos. What do they tell you about the coast at Newquay? Is it flat? Smooth? Any beaches? See if you can write four sentences about it.

2 Find Towan Head on the map. (It's in square 7962.)
   a What is *Head* short for?
   b How was Towan Head formed?
   c Find two other examples of this landform on the map. Give their names.
   d What can you say about the rock in those places?

3 Look at the tiny island on the left in photo **B**. On the map, it's at 811618, near the aquarium. Do you think the island was always like this? Explain.

4 Look at photo **C**. It shows some of Newquay's beaches. See which ones you can name, with help from the map.

5 Now, holiday time. You are off to Newquay on a five-day camping holiday, in August, with your friends.

I'm hungry. I'm tired. Hurry up, you lot.

   a They let you pick a camp site, from the map. Which one will you choose? Give a 6-figure grid reference for it, and say why you chose it.
   b The map gives plenty of clues about things to see and do, in Newquay. List as many as you can. Then tick the ones that appeal to you.
   c You will go there by train. Where is the station? Give a 6-figure grid reference for it.
   d From the station, you'll go straight to the tourist information office, to find out about surfing lessons.
      i About how far is the office from the station?
      ii In which direction will you walk?

6 You book some surfing lessons. They will be at Lusty Glaze beach. (See photo **A**.)
   a You will walk to lessons from your camp site. See if you can draw a sketch map of your route. Mark in any landmarks, and say how long the route is.
   b Lessons will start at 9 in the morning. By what time do you think you'll need to leave the camp site?

7 You see lots of other surfers, from the UK and many other countries. Some flew in to Newquay Cornwall airport, which was once an RAF base.
   a Find the airport on the map. Give a grid reference for one square of it.
   b It is Cornwall's main airport. It hopes to attract more and more flights, and to handle at least 1 million passengers a year, by 2020. (They won't all be staying in Newquay!)
      i How might more flights benefit Newquay? List as many benefits as you can.
      ii What problems might they cause?
   c A change is *sustainable* if it continues to benefit us *economically* and *socially*, into the future, *without harming the environment*. (Glossary?)
      i Do *you* think an increase in flights into Newquay Cornwall airport is sustainable? Give your reasons.
      ii Imagine you are in charge of Newquay. Will you give permission for the extra flights?

8 Home again. And now you will write a blog about Newquay, for your web page. Say where it is, and what it's like, and what you did. Make it fun! What photos will you add to your page? And what about a map?

Scale 1:50 000

0   0.5   1 km

A

Watergate
Bay

Berryl's Point
Mawgan
Porth
PH
Gluvian
Fm
The
Beacon
Beacon Cove
Griffin's Point
Fort
75
Trevarrian
PH
Tolcarne
Merock
Polgreen
Cemy
Stem Point
85
Strasse Cliff
South West Coast Path
85
94
Carloggas

Tregurrian
Newquay
Airport
Hotel
Penvose
Fm
St Mawgan
PC
B 3276

Horse Rock
Twr
69
Trebelsue
Fm
Higher
Trewince
Twr
Zacry's Island
73
Trevelgue

94 Wr
Twr
Flory
Island
Hotel
Tregustick
Fm
MS
Fort
Whipsiderry
Tumuli
Penrose
Trevelgue Head
Porth
St Columb
Minor
Tregenna
CH
Treloy
Trebarber
Lusty
Glaze
Caves
13
MS
Newquay
Bay
Tumuli
Sch
Melancoose
Towan Head
PC
63
Aquarium
Caves
43
A 3058
37
Rialton
Barton
21
Settlement
Gazzle
Hotel
PC
Cross
Old Dane
LB
Sta
Sch
Gusti
Veor
Cemy
P
Fistral
Bay
Fistral
Beach
CH
Cemy
NEWQUAY
Trewollack
Fm
East
Panhill
The Goose
Pentire Point East
Tumulus
PH
Hosp
Zoo
Leisure
Park
Gusti
Vean
Lowertown
West
Pentire
(summer only)
Crantock
Beach
Penpol
Trenance
Trencreek
Chapel
Quintrell
PHDowns
66
Bejowan
Vugga
Cove
42
The Gannel
Treninnick
Lane
A 392
LC
86
Hotel
78
Treago
Fm
81
82
Treringey
Round
Hendra
Manuels
Trethiggy
Fm
94
Coswarthe
77
Crantock
Trovella
60
Trevithick
Manor
Trevilley Court
Fm
Legonna
Cumulus
Treringey
Trevowah
Trevemper
PH
Kestle
Mill
Kestle
The
Kelseys
Cubert
Common
55
R Gannel
Gwills
Trevarthian
Lewannick
Tumulus
Carines
55
Roseeliston
Park
Wks
Polgreen
Trevean
Well
Fun
Park
CH
Treworgans
Carevick
67
Tregair
Fm
Trerice
Tregon
Trevornick
Tresean
Treworthal
Trewerry
Mill
Tresillian
Ho
71
Farm Park
75
Trevail
Cemy
Trenissick
Trerew Fm

77   78   79   80   81   82   83   84   85   86

B

C

59

Under threat from the sea

Rivers can flood streets, and homes. So can the sea! Find out more here.

We can't control it

It's wonderful being surrounded by sea. It means beaches, and busy ports, and water sports, and sea views, and fun. But every so often, the sea reminds us that we can't control it.

Storm surge, December 2013

On 5 and 6 December 2013, our coastline took a battering from the sea.

Gale force winds pushed big waves towards the coast. In some places, seawater flooded over sea walls that had been built to keep it out. It swept along streets, and into shops and homes.

Britain's east coast got the worst of it. A high volume of water rolled down the North Sea, in a storm surge. The waves lashed at the coast. Thousands of people were evacuated from their homes, for safety. Hundreds of homes were flooded.

In Norfolk, erosion was the problem. The raging sea ate into soft cliffs, causing them to collapse. In the village of Hemsby, the cliff fell away below seven homes. Three of them slid into the water, and were carried off like toys.

On both days, the Thames Barrier was closed to protect London.

But there was good news too. Coastal defences in many places held up well, protecting hundreds of thousands of properties. Without them, the damage wreaked by the sea would have been much much greater.

▲ The sea flooded roads and homes in Rhyl, north Wales, on 5 December 2013.

▲ In Hemsby, Norfolk, the sea ate into these soft cliffs.

▲ Prestonpans in Scotland, under attack.

▲ The sea flooded into Scarborough.

Why did it happen?

Three factors combined to create the storm that flooded the coast.

low pressure means air is rising, so ... ... the sea bulges up a little

Air pressure was low. That means air was rising. When this happens, the sea is drawn upwards a little.

at high tide the water level is even higher
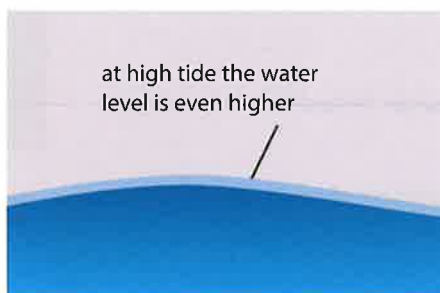
The **high tides** were also at their highest, at that time of the month. This added to the water level.

big waves
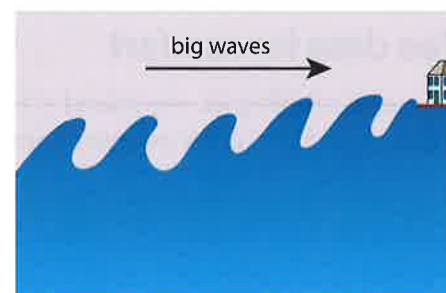
But the main factor was the **strong winds**. They whipped up the waves and pushed them onto the coast.

The storm surge at the east coast

The east coast suffered most. This map shows why.

❶ The system of low pressure passed north of Scotland, heading east.

❷ The winds and high water level caused a **storm surge** – a big surge of water. It swept down the North Sea. The waves, whipped by the wind, hammered the east coast.

❸ The surge grew higher as it moved further south, where the North Sea gets narrower and more shallow. So the flood risk grew too.

❹ Then the surge headed north again, flooding the coasts of other European countries.

Now look at the yellow lines on the map, along Britain's coast. They show where the rock is soft or quite soft, and easily eroded.

Several parts of the east coast are easily eroded. So they are at risk, and especially in a storm surge. You'll see an example in the next unit.

low pressure

erodes easily

How long can Happisburgh hang on ?

This is about erosion in one village on the UK's east coast: Happisburgh in Norfolk. (Say *Haisbro*.)

The Wash

Happisburgh

Too close for comfort

The sea is nibbling its way inland at Happisburgh in Norfolk. It has taken the ground from under people's homes.

A

12 December 2013

▲ *Bryony's house, on the edge. Look for it (●) in the other photos, taken in earlier years.*

The last house on Beach Road

Bryony looks sadly at her house, as it teeters on the edge of the cliff. The bathroom lies on the beach below. Later today, bulldozers will arrive to demolish the rest.

Bryony bought the house 5 years ago. She loved its sea views. She had hoped it would stand for at least 25 years. But erosion in Happisburgh has been much faster than anyone expected.

As time went by, bits of her garden slid away. Then just last week, on 5 December, came the storm surge. It was the worst sea storm in over 60 years. High waves lashed the coast. A chunk of cliff below her house collapsed … and part of the house went too.

Once there were homes all along Beach Road. Now Bryony is the only resident. Soon she'll be gone too. But the sea will not stop. And one day, who knows when, there will be nothing left of Happisburgh.

12 December 2013

Why is erosion so severe at Happisburgh ?

The coast at Happisburgh is eroding faster than anywhere else in the UK. Why ?

B

Beach Road

August 2009

1 The main reason is that the cliffs are soft – sand on top and clay below.

2 Rain soaks into the cliffs and helps to weaken them. The more it rains, the weaker they get.

3 Meanwhile, the sea erodes them from below. Not so much in summer, when the weather is calmer …

4 … but winter brings strong north winds, and storms, and sometimes storm surges. Waves lash the cliffs, and chunks collapse.

5 Groynes help to slow down erosion. (They keep sand in place, and sand absorbs some of the waves' energy.) But groynes break up over time too.

6 These wooden barriers or **revetments** are meant to slow down erosion, by making waves break early. But they were damaged in a past storm, and not repaired.

7 A line of big rocks, called **rock armour**, has been put in place to protect the cliffs from the full force of the waves. It works – but there isn't enough of it.

1 Where in the UK is Happisburgh? (Say *Haisbro*.)
   On which coast? On which sea? Give its location as fully as
   you can. (Page 139 may help.)

2 What part did each play, in the loss of Bryony's home and
   garden?
   a the material the cliffs are made of
   b rain
   c strong north winds (*from* the north; look for the arrow
      pointing north, on the photos!)
   d the storm surge in December 2013

3 Look at the aerial photos of Happisburgh, below.
   a Photo **C** shows wooden barriers on the beach.
      i What are the barriers at right angles to the cliffs called?
         What is their job?
      ii What are the ones parallel to the cliffs called?
         What is their job?
   b Photo **D** shows another type of barrier, not made of wood.
      (Look at photo **B** too.) What is it called?

4 a Now, for photos **C** and **D**, list all the changes you notice for
      that stretch of coast, between 1996 and 2012.
   b From the photos, do you think those barriers have been
      effective against erosion? Give evidence.

5 Look at the church in photo **D**.
   In January 2014, it stood about 140 m from the cliff edge.
   Suppose the cliffs are eroding at an average rate of 20 m a year.
   In which year might the church be lost to the sea?

6 Look at the caravan park in photo **D**. It's marked by the red dot.
   You own it! And you want to move it to a corner of the field with
   the yellow dot.
   Write to the council, to ask for permission to do this.
   Give your reasons for wanting to move. And say why a caravan
   park is really important for Happisburgh.

7 Around 1400 people live in Happisburgh. How might cliff erosion
   affect them? See how many ways you can think of. (Don't forget
   mental and *financial* impacts.)

Beach Road
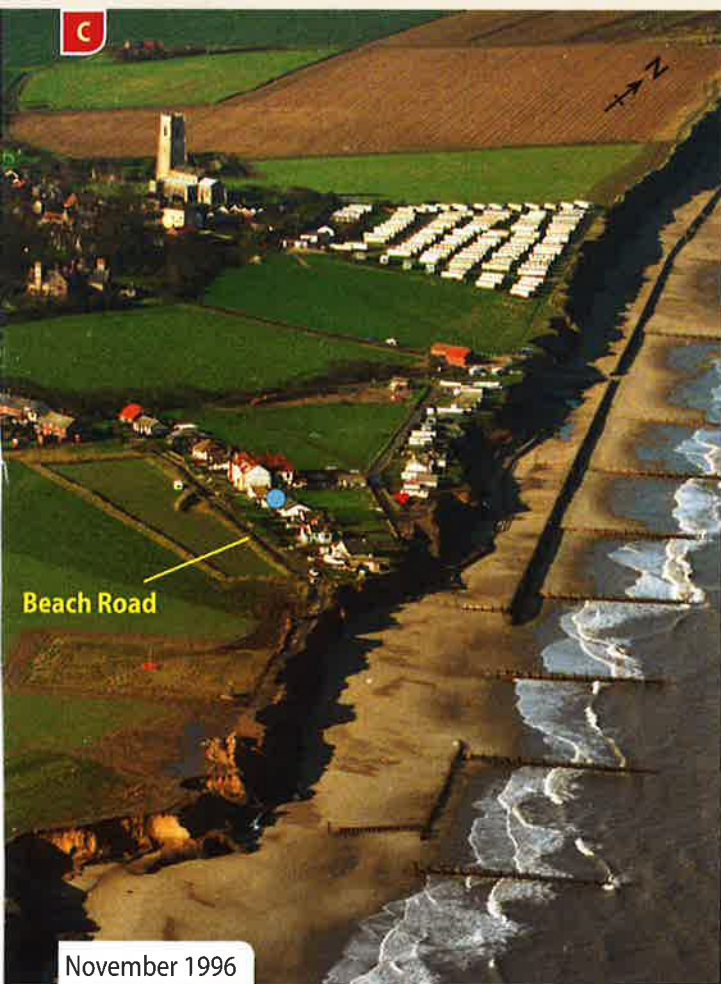
November 1996

▲ *Happisburgh in 1996. Look for Bryony's house (●)
Compare this photo with **D**, taken 16 years later.*

Beach Road

August 2012

▲ *Over the years, several houses slid into the sea. The council demolished
others that were at risk (and paid compensation).*

Protecting places from the sea

How can we stop our places being flooded and eroded by the sea?
Find out in this unit.

How can we protect places?

It is natural for the sea to flood the coast, and erode the rocks.
So how can we protect places? We can try to:

- keep the sea away
- reduce the energy of the waves, so that they do less damage.

Look at these methods. You have met some of them already.

Cost of coastal defences	
Sea wall	£5000 / metre
Rock armour	£2500 / metre
Wooden revetment	£1500 / metre
Typical rock groyne	£125 000
Typical wooden groyne	£100 000

Sea walls are the usual way to keep the sea out. They are often curved, to reflect the waves away.

Rock armour (big rocks) soaks up the waves' energy. It slows down the erosion of cliffs, and sea walls.

You could build an artificial **reef** of rocks out at sea, so that the waves break earlier, away from the beach.
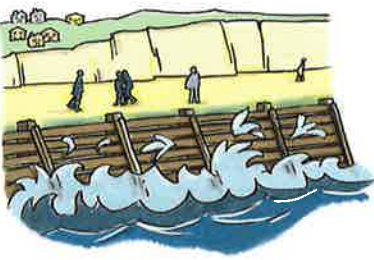
You could build **revetments**, which are a bit like fences. The waves batter them instead of the cliffs.

Groynes help, because they stop sand being carried away. Sand absorbs some of the waves' energy.

You could even add more sand or shingle to a beach, to build it up. This is called **beach nourishment**.

But the trouble is …

- Coastal defences cost a lot. Look at the table above.
- Most defences break down eventually, or get washed away.
- Defences may do harm elsewhere. For example, protecting a cliff from erosion may starve a beach of sand, further down the coast.
- And the biggest challenge of all … the climate is changing. Experts say sea levels will rise, and storms will be more frequent and severe. So our existing defences may fail.

Protecting the coast, in a way that will last, is a huge challenge!

▶ *Scarborough, on the east coast, got new coastal defences in 2005. Cost: £53 million. Now look at photo C on page 60.*

So who decides?

Most of the money for coastal defences comes from the government.
There is only a limited amount of money, so it has to make choices.

We need money for schools and hospitals …

… and roads and railways, and the army and things.

So we can't afford to build coastal defences everywhere.

We must weigh everything up, and spend wisely.

We must not forget climate change.

We have to plan far ahead, not just for next year.

The plans for the coast

Now plans have been drawn up for Britain's coastline – for the next 100 years! They take climate change into account. Look:

1   We'll protect places which have enough homes and businesses to make them worth protecting.

2   We'll also protect special places – such as key historical sites, or nature reserves.

3   We will not protect other places! And in time, the sea will drown them. But we will help local people to prepare for this.

Sadly, nothing more will be done to protect Happisburgh. It is small, and defences would cost too much. So its future lies in the sea.

▲ *The Thames Barrier, closed. It's always closed during a storm surge in the North Sea, to protect London.*

Your turn

1   Look at the coastal defences on page 64.
 a   Which type is meant to keep seawater out of a place?
 b   Which type makes waves break earlier, out at sea?
 c   Which three types are the most likely to be damaged, or washed away, in a storm?
 d   Which one may need replacing most often?

2   Sea walls would not work for Happisburgh. Why not?

3   Look at the opinions on the right. Choose three, and write replies. You can agree or disagree with the speaker. Give your reasons each time.

4   You live in Happisburgh, near the church (page 63). You want to sell your house. But no one will buy it, because of cliff erosion. What will you do? Come up with a plan.

a   It's not fair. They MUST protect Happisburgh.

b   Protect homes, not nature reserves!

c   Places should pay for their own defences. It's their problem!

d   Don't let people build where there's a flood risk.

e   Move everyone away from the coast. That will solve the problem.

Weather and climate

The big picture

This chapter is all about **weather** and **climate**. Here's the big picture …

- Weather is the state of the atmosphere around us. (Warm? wet? windy?) It can change from hour to hour.
- All weather is caused by one thing: the Sun heating Earth unevenly.
- Climate is the 'average' weather in a place – what it is usually like there.
- Distance from the Equator is the main factor that dictates climate.
- But other factors influence it too. For example how high up the place is, how far from the coast, and where the winds blow from.
- Earth can be divided into different climate regions.

Your goals for this chapter

By the end of this chapter, you should be able to answer these questions:

- What is weather, and what causes it?
- What do these terms mean?

  temperature   precipitation   air pressure
  wind speed   wind direction

- What are the three different kinds of rainfall, and how does each form?
- What kind of weather is linked to:

  low pressure?   high pressure in summer?   high pressure in winter?

- The weather in the UK can change very quickly. Why?
- What do these terms mean?

  air mass   warm front   cold front

- In geography, what is a depression? How does it form?
- What's the difference between weather and climate?
- What factors influence climate? And which is the main one?
- Earth can be divided into regions with very different climates. What examples can I give? (Try for least five!)

And then …

When you finish the chapter, come back here and see if you have met your goals!

Did you know?

- The wettest place in the world is said to be Mawsynram in India (1169 cm of rain/year).

Did you know?

- The lowest ever recorded temperature was −89.2 °C, in Antarctica, on 21 July 1983.

What if…

- …the weather were the same every single day?

What if…

- …climate were the same all over the world?

Why…

- … does the wind blow?

Your chapter starter

Look at the photo on page 66.

What's that white stuff?

What caused it?

How would it feel to be there? What kinds of things could you do?

What might this place look like in six months' time?

Out, penguin.

It's the weather!

In this unit, you'll think about different kinds of weather.

Hot, cold, wet, dry, windy?

It's all around you. It affects what you wear, and what you do, and how you feel. You can't control it. It's the weather!

Look at the photos, and then try 'Your turn'.

F

G

H

I
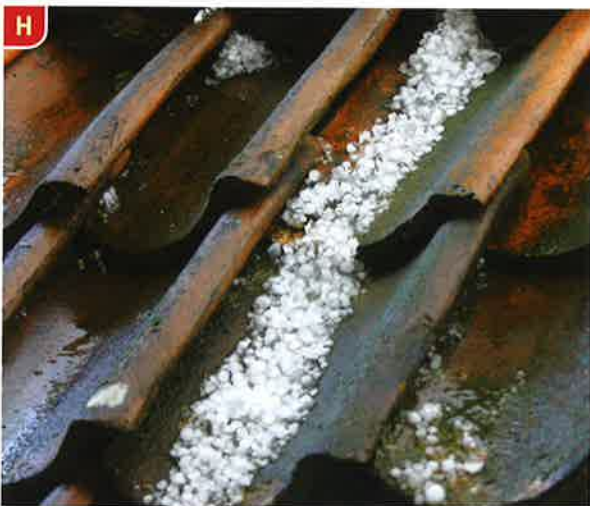
Your turn

1 Look at each photo in turn. What's the weather like in that place? Write a sentence of at least ten words to describe it. For example, does it seem to be windy? Is it cloudy? Damp? Warm?

2 Now choose the two photos that you think show:
   a the most similar weather
   b the most 'opposite' weather
   Each time, explain your choice.

3 If you could be in one of the places in the photos, that day …
   a which place would you choose? Why?
   b which place would you least like to be in? Why?

4 Which of the photos do you think were *not* taken in the UK? Explain your choice.

5 Can weather be dangerous? If you think so, give examples. The photos may help.

6 a So what exactly is *weather*? See if you can write a definition for it. All in your own words!
   b Now compare your definition with the one in the glossary. Which one do you think is better? Why?

7 Look again at the photos. The Sun is at the root of all this weather. For example, it caused the mist and snow and rain. How did it do that? See if you can explain.

So what causes weather?

In this unit you'll learn what drives the weather.

It's the Sun!

The weather. Windy? Wet? Warm? The Sun is behind it all …

rays from the Sun
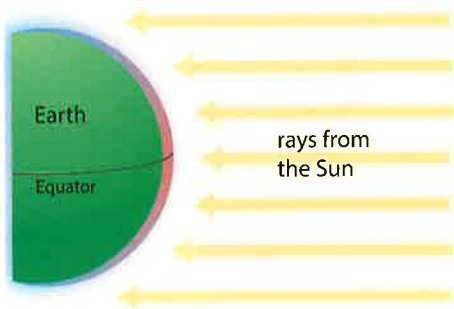
The Sun heats Earth. But it does not heat it *evenly*, because Earth is round. The top and bottom don't warm up much.

the warm air rises, and is pushed away as cold air takes its place
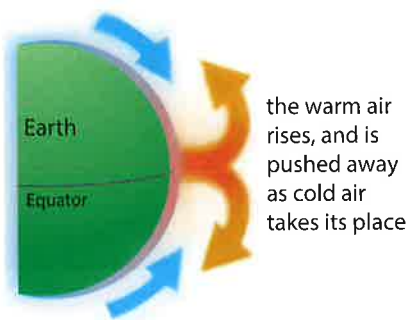
Earth in turn heats the air. The warm air rises. Air from a colder place then flows in to replace it, as **wind**. (Wind is just air on the move.)

water vapour rising (it's invisible)
ocean
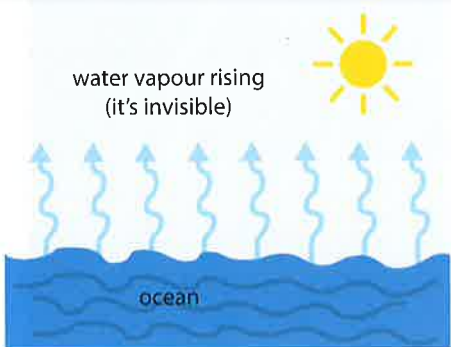
The Sun also warms the oceans. This causes water to evaporate to give a gas, **water vapour**. That gas plays a big part in the weather.

water vapour everywhere
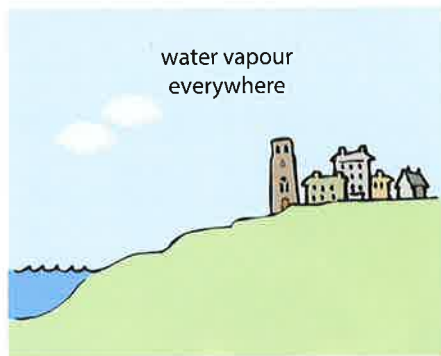
The water vapour mixes through the air, helped by wind. So there is some in the air around you, even if you are miles from water.
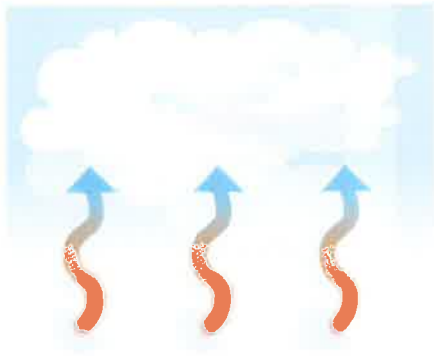
Now look what happens when air rises. It cools, which causes the water vapour to **condense** again, into **clouds** of tiny water droplets.

Hair ruined … again.

The tiny droplets may join to form bigger drops. When these grow heavy enough, they fall from the sky as rain. It might rain all day.

Here today, gone tomorrow.

If the air is very cold, the water droplets may fall instead as **snow**, or **sleet**, or **hailstones**. It depends on the air temperature.

Over here, I think.
Where are you?

Water vapour may also condense lower down in the air. For example in chilly weather, it may condense all around us as **fog**.

Your eyes, they sparkle like the morning dew.
Get away with you.

Or it may hang in the air as mist. Or condense on grass and leaves overnight, as **dew**. Mist and dew evaporate again in the sunshine.

What causes weather: a summary

So let's sum it up.

1 The Sun heats Earth – but unevenly.

2 Earth in turn warms the air, which rises.

3 Rising air leads to wind, because air from a colder place flows in to replace it.

4 The Sun's heat also causes water to evaporate, giving water vapour.

5 When the air rises it cools. So the water vapour condenses, giving clouds of water droplets. Droplets join to make larger drops, which fall as rain (or snow, or sleet, or hailstones).

Where does weather happen ?

Look up at the sky. You are looking into the atmosphere – the blanket of gas around Earth. It reaches up to 10 000 km. Think about that !

Most of the gas molecules are in the lowest layer, because they are pulled down by gravity. This layer is called the **troposphere**. It is 11 km deep, on average. Almost all the water vapour in the atmosphere is here.

Because it has most of the gas, the troposphere is where most weather occurs. Above it, there is no rain.

Altitude (km)

exosphere (merges with outer space) — 10 000

— 700

spaceflight to the moon

— 400

International Space Station (300 - 410 km)

thermosphere

mesosphere — 80 / 70 / 60

ozone layer — 50 / 40

stratosphere — 30 / 20

jet — 10

weather zone | Mt Everest | troposphere — 0

▲ *The layers of the atmosphere.*

Are we nearly there?

▲ *Jet planes often fly above the troposphere. Can you think of a reason ?*

Your turn

1 When we think of weather, we think about how warm or cold it is, or wet, or cloudy, or windy.

Copy and complete this paragraph, using words from the brackets below.

Places get warm because of the _____. It heats _____, which in turn _____ the air. The Sun also causes _____. That's because the warm air _____, so _____ air rushes in from somewhere else to take its place. As warm air rises it _____, and the water vapour _____. That's why we get clouds, and rain.

(*condenses wind cools colder Earth rises Sun warms*)

2 a What is *water vapour* ?

b See if you can think of a way to prove that there's water vapour in the air around you. (Condensation ?)

3 All these have something in common. What is it?
hailstones   mist   fog   rain   snow

4 a What is the *atmosphere* ?

b Which layer of it do we live in?

c There's no rain up in the *stratosphere*. Why not?

5 What do you think the weather would be like if the Sun could heat all of Earth evenly ?

71

Measuring the weather

This is about measuring weather: which aspects we measure, and how, and what units we use.

Weather: getting the full picture

Weather means the state of the atmosphere in a place.
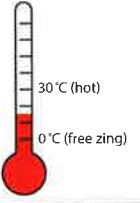
Our eyes and skin tell us lots about the weather. Look at photo **A**. If you were there, you'd feel the wind on your skin, and see the clouds. You'd feel how warm or cold the air was.

But to describe weather fully, we must **measure**.

What gets measured?
This table shows the five main things we measure, to describe the state of the atmosphere.

We measure ...	It tells us ...	The measurement is given ...	We measure using ...	It looks like ...
temperature	how hot or cold a place is	in degrees Celsius (°C) On a hot day in the UK it could be 30°C. On a winter's day, 0°C or less.	a thermometer	
precipitation	how much water has fallen from the sky (as rain, snow, sleet, hail ...) We collect it in a container, and measure the depth of the liquid.	in millimetres or centimetres	a rain gauge It's a container with a scale marked on it.	
air pressure	the force pressing down on us because of the weight of the air If air pressure is rising, it means air is sinking, and vice versa. That tells us what kind of weather to expect.	in millibars (mb) It is usually in the range 970 mb to 1040 mb.	a barometer	
wind speed	how fast the wind is blowing	in miles per hour (mph) or kilometres per hour (kph) In a storm, winds in the UK can reach 100 mph and more.	an anemometer It has a set of little cups which the wind turns; a dial shows the speed.	
wind direction	the direction the wind is blowing from	using compass directions A south west wind blows *from* the south west.	a wind vane, as shown here, or a wind sock A wind sock is a fabric tube that the wind blows through. It changes direction with the wind.	

▲ Four times a day, weather balloons are launched from six sites in the UK. The little package collects and transmits data.

Key

15	Temperature (°C)
(20)↗	Wind speed (mph) and direction
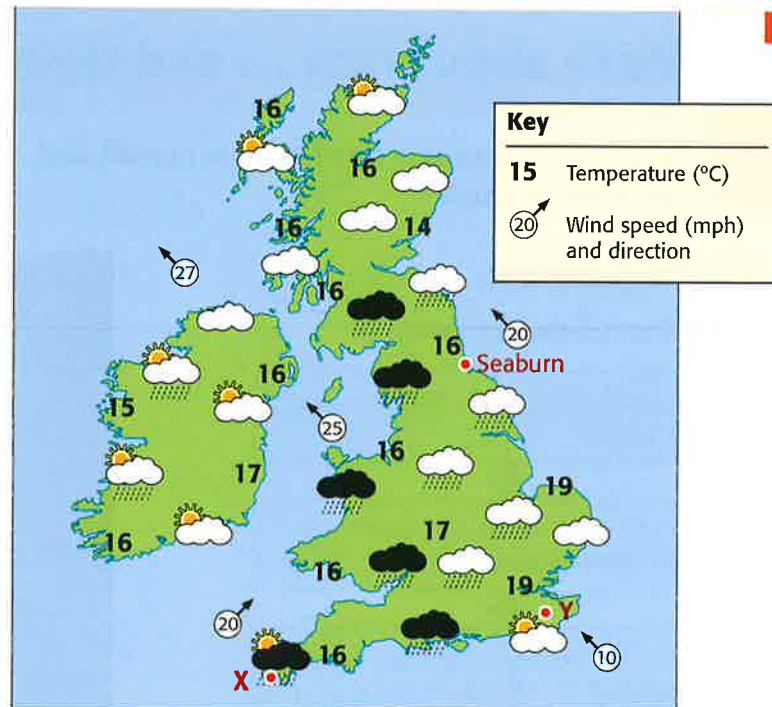
▲ In newspapers and on TV you get maps like this, to show what the weather was like yesterday – or what to expect tomorrow.

Who measures?

Everyone! Your school may have a weather station. Ships and planes carry instruments for measuring the weather. The **Met Office**, which gives out weather forecasts in the UK, has weather stations across the UK.

Up in space, weather satellites take images of the cloud patterns below them. These are very helpful in making weather forecasts.

Why...
 ◆ ... is the sky blue?

Your turn

1 Write the correct definition for weather, in ten words.

2 What has the weather been like over the last week? Did it change much? Describe it as fully as you can.

3 a What is *air pressure*?
   b Why is it a really useful thing to measure?

4 These are the names of some devices used in measuring weather. But they are all jumbled up.

   tamnreeeom   omaretrbe   ttemreheomr   nari guega

   Unjumble each one. Then write down three things:
   a the name of the device
   b what it measures
   c the units that are used

5 The table on page 72 lists five things to measure, for weather. Which other aspects of weather could be measured? See how many you can think of.

6 To many groups of people – such as sailors – a weather forecast is essential. Which other groups can you think of? For each group, explain your choice.

7 Look at the weather map above. Below are symbols it uses. Say what you think each means. (The map key will help.)

   a ⌒cloud   b ☀cloud   c ⌒rain
   d ☀cloud rain   e ■rain   f ☀■rain
   g (20)↗   h (10)↙   i **16**

8 Photo **A** on page 72 shows Seaburn in Sunderland, on the day the weather map was drawn.
   a Look for it on the weather map.
   b Using both the photo and map, describe the weather around Seaburn that day as fully as you can.
   c Was it cold there, that day? What is your evidence?

9 Now say what the weather was like that day at:
   a X on the weather map
   b Y on the weather map
   c where you live

More about rain … and clouds

Here you'll learn about three kinds of rainfall, and two kinds of cloud.

Rain: a reminder

All rain forms in the same way.

> The Sun warms the water in the oceans, and rivers, and lakes.

⬇

> Some water evaporates to form an invisible gas called **water vapour**. It goes into the air.

⬇

> When air rises, it cools. So the water vapour **condenses** to give **clouds** of water droplets.

⬇

> Droplets join to form bigger drops. When these grow heavy enough, they fall as **rain**.

But air rises for different reasons. So rainfall is given different names. Let's look at them now.

1 Convectional rainfall

In this diagram, air is rising because the ground is heating it.

It rises as currents of warm air. We call these **convection currents**. So we call the rain **convectional rainfall**.

In the UK we get convectional rainfall inland in summer, where the ground gets hottest, away from the cooling effect of the sea.

3 The rising air cools. The water vapour condenses. Clouds form. It rains.

2 Currents of warm air rise.

1 The Sun warms the ground … which then warms the air above it.
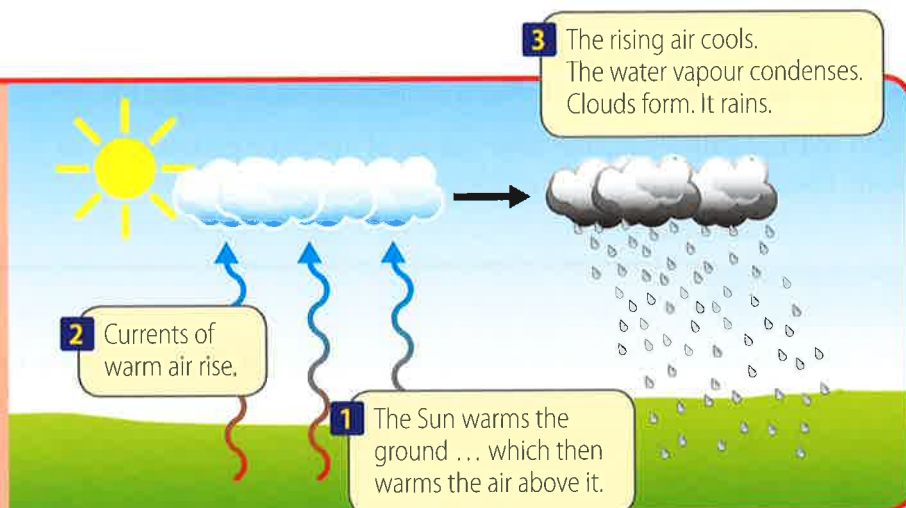
2 Relief rainfall

Wind is just moving air.

When the wind meets a line of high hills or mountains, there's only one way to go – up! So the air rises and cools, and we get rain. We call it **relief rainfall**.

In the UK the prevailing wind is a moist south west wind from the Atlantic. So we get lots of relief rainfall on the high land on the west coast.

3 The rising air cools. The water vapour condenses. Clouds form. It rains.

2 The air is forced to rise.

1 Warm moist air arrives from the Atlantic Ocean.

leeward (sheltered)

windward (facing the wind)

4 The rain falls on the **windward** side of the mountain. The **leeward** side stays dry.
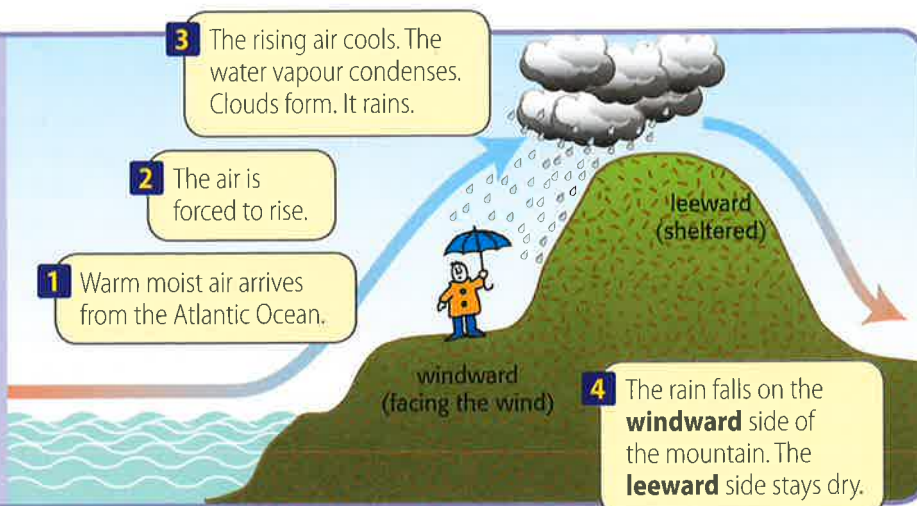
3 Frontal rainfall

As you'll see in Unit 5.6, huge blocks of air called **air masses** move around Earth.

Where a warm air mass meets a cold one, the warm air rises. Its water vapour condenses. So we get rain. This is called **frontal rainfall**.

Air masses can travel anywhere. So frontal rainfall can fall anywhere. It is the most common type of rainfall in the UK.

warm

2 The warm air mass slides up over the cold one, or gets pushed up by it.

1 A warm air mass meets a cold air mass.

3 The rising air cools. The water vapour condenses. Clouds form. It rains.

cold
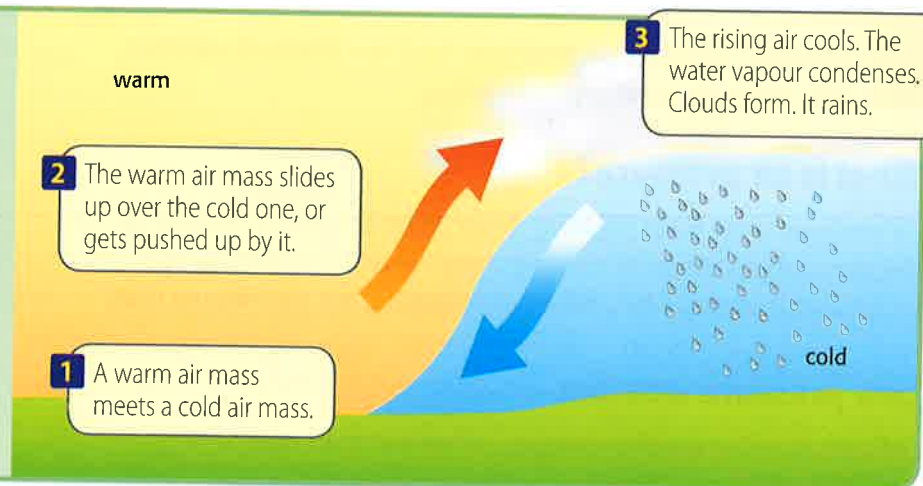
Different types of cloud

There are different types of cloud too. Here are two common types.

Cumulus clouds

These fluffy clouds form when warm air rises fast. For example when the ground heats the air quickly on a hot day, or mountains force air to rise. They can give short heavy showers. But on a very hot day they can grow into tall dark thunderclouds, which bring very heavy rain.

Stratus clouds

These are blankets of dull cloud. They form when air rises more slowly, over a wide area – for example when a warm air mass meets a colder one. Stratus clouds bring drizzle, but not heavy showers.

Your turn

1   Why is *relief* rainfall called that? (Glossary?)
2   The most common type of rainfall in the UK is …?
3   To form clouds, two things are always needed. Which are they? Choose from this list:
    wind   rising air   mountains   hot sun
    warm ground   water vapour
4   **a**   Do you think clouds can form in the dark? Explain.
    b   Do clouds always lead to rain? Explain.
5   Look at this photo. It was taken on a hot afternoon. Two hours earlier, there were no clouds in the sky.
    a   Which kind of clouds are they?
    b   What do you think caused them to form?
6   Look on page 139. The Cambrian Mountains get lots of rain. Explain why, and say which type of rainfall it is.

6 August, 3 pm

Air pressure

This unit is about air pressure, and the kinds of weather that high and low pressure bring.

What is air pressure?

Air pressure is the force pressing down on us, due to the weight of the atmosphere. When air is rising, there's less force pressing down on us. So the air pressure falls. When air is sinking, the air pressure rises.

Low pressure weather

Let's see how the weather changes, when warm air rises:

3 As the rising air cools, clouds form. Then it rains.

wind

falling pressure

higher pressure

A   B

1 Warm air is rising here, around A. So the air pressure falls at A.

2 The air pressure at B is now higher than at A. So air rushes from B to A as **wind**.

So falling air pressure at A is a sign of wind and rain on the way. The lower the pressure, the worse the weather will be.

High pressure weather

When warm air rises in one place, cold air sinks somewhere else – giving high pressure.

2 ... so cold air gets pushed aside ...

3 ... and far away, at Y, it sinks. So the air pressure rises, giving high pressure at Y.

4 As the cold air sinks it warms up. So no water vapour condenses. No clouds form over Y. The sky stays clear.

1 Warm air is rising at X ...

X   Y
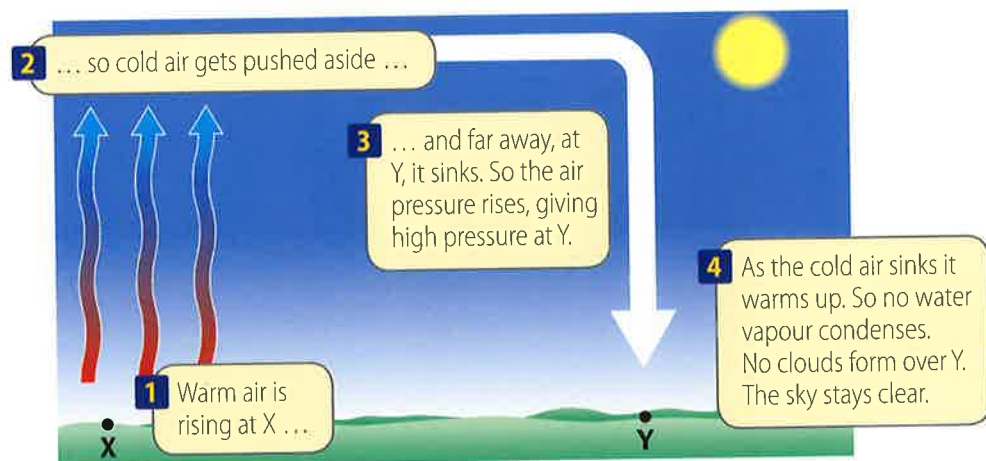
So high pressure means clear skies, with no clouds. And that gives our hottest summer weather, and coldest winter weather, as you'll see next.

▲ Low pressure weather. In winter, you might get heavy snow instead of rain.

▲ To see if the air pressure is rising or falling, tap on a barometer.

When there's high pressure in summer …

There are no clouds in the way, so the sun is strong. Take care you don't get burned!

No cloud means no rain. So there may be **drought** in some places.

But inland, on very hot cloudless days, the hot air may rise rapidly. It cools, and tall black clouds form.

Since there is no cloud to trap the heat in, evenings can be cool.

Inside these clouds, strong currents of air whip around, causing **thunderstorms** …

No cloud also means the ground gets cold at night. Water vapour condenses on grass to form **dew**.

… and thunderstorms can lead to heavy rain, and **flooding**.

When there's high pressure in winter …

There is no cloud to act as a blanket. So the days are clear, cold, and bright.

With no cloud, the ground cools fast at night, and cools the air above it. Water vapour condenses and freezes on cold surfaces, giving **frost**.

Water vapour also condenses on dust and other particles in the air, giving **fog**. This makes driving dangerous.

Water on roads freezes to **ice** as the Sun goes down.

Ice and frost mean animals have trouble finding food.

Pipes may burst and homes may get flooded.

Your turn

1 Write this out, using the correct word from each pair.
   Low pressure is a sign of fine/unsettled weather. The lower the pressure the calmer/stormier the weather will be. High pressure brings clear/cloudy skies, which means very hot/cold weather in summer and very warm/cold weather in winter.

2 For people doing some jobs, long spells of high pressure weather can bring problems. Try to give three examples.

3 For people doing some jobs, long spells of low pressure weather can bring problems. Give three examples.

4 It's August. Air pressure is high. You are going camping. List four items you'll pack, to cope with the weather.

5 **a** Which type of air pressure is linked to fog and frost?
   b Explain how each forms.

6 Which type of weather do you prefer – high or low pressure? And in which season? Give your reasons.

Why is our weather so changeable ?

> Here you will learn why our weather can change so quickly.

Our changeable weather

Our weather can change really fast in the UK. Warm and sunny one day. Cool, wet, and windy the next. Why? Because blocks of air are on the move.

Air on the move

Some parts of Earth are hot. Some are cold. This causes the air to move around – like the air in a cold room when you turn on a heater.

Warm air always moves from a warmer place to a colder one. So the cold air is pushed towards the warmer place. This is Nature's way of spreading heat around. Look at the simple model on the right.
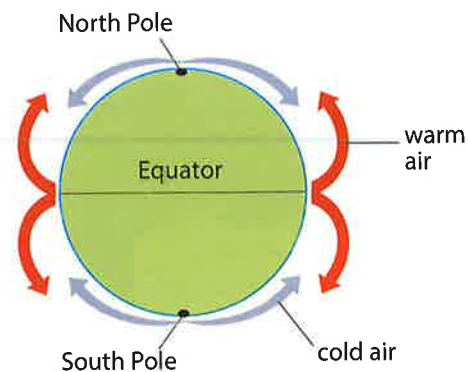
▲ *Warm and cold air on the move around Earth. It is Nature's way of spreading heat.*

Air masses

The air moves in huge blocks called **air masses**. An air mass will be warm or cold, damp or dry, depending on where it came from.

An air mass coming from the North Pole will be cold and dry ...

... so if it moves over the UK you'll get cold dry weather.
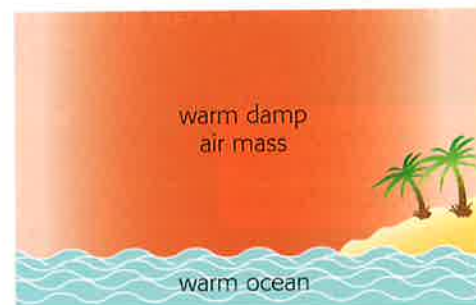
An air mass coming from a warm ocean will be warm and damp ...

... and if it moves over the UK you get warm dampish weather.
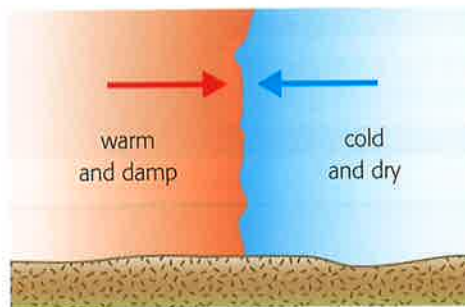
Often, two very different air masses will meet, and clash ...

... and this causes sudden changes in the weather!

Air masses and us

The UK is almost halfway between the cold North Pole and hot Equator. So it lies in a zone where very different air masses often meet and clash. That's the main reason why our weather can change so fast.

How an air mass changes the weather

An air mass can bring wind, rain, and a change in temperature. Like this:

8 am — *Nice dry morning. But cool.*

There's a cold air mass in your area.

So the morning is cool. And there's high pressure, so the sky is clear.

But a warm damp air mass is on the way. How will it affect the weather?

midday — warm front — warm air sliding up — stratus clouds
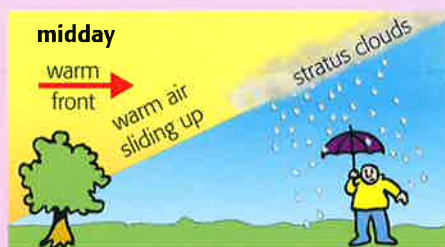
The warm air mass has arrived.

1 It slides up over the cold one.

2 As it rises, the air pressure falls. So the weather gets windy.

3 As the rising air cools, a bank of cloud forms. It starts to rain.

4 pm — *Time to put away the brolly !*

It's a few hours later.

The cold air mass has moved off. The warm air mass has taken over.

So the afternoon feels warmer. The rain has eased off. The wind has dropped.

If a warm air mass is in place, and a cold one arrives, you get even worse weather. That's because a cold air mass travels fast, and dives under the warm air mass, and shoves it upwards. You get strong gusty winds, thick cloud, and heavy rain.

Fronts

The leading edge of an air mass is called a **front**.

A **warm front** means a warm air mass is arriving.

A warm front is shown on a weather map like this.
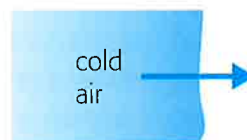
A **cold front** means a cold air mass is arriving.

It's shown on a weather map like this.

Your turn

1 What is an *air mass*?

2 Five main types of air mass cross Britain. This map shows where they come from. (See page 141 too.)
Answer these questions by giving the labels A – E:

a Which air mass do you think is coldest, and dry? Why?

b Which two are dampest? Why?

c Which one is very cold and dry in winter, but warmer in summer? Try to explain why.

d Which one is warm even in winter?

3 a What is: i a warm front? ii a cold front?

b Draw symbols for warm and cold fronts. Beside each, write the words *warmer* and *colder* where you think they should go.

Greenland

Arctic Circle

B

A

C

Europe

E

D

Africa

N
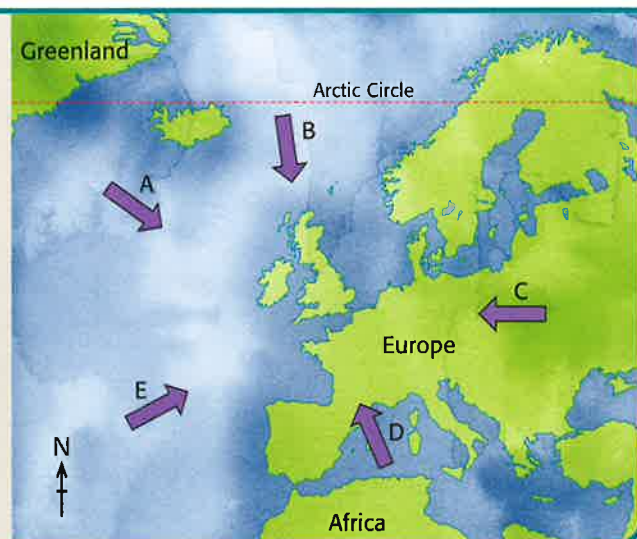
A winter of storms

Find out about the storms that battered the UK one winter – and what caused them.

Storm after storm after storm

We are used to winter storms, here in the UK. But the winter of 2013/14 was one we won't forget. It brought:

- the worst storms for 20 years
- more days with severe gales than any of the previous 140 winters
- more rain than any of the previous 250 winters
- over £1 billion of damage, caused by floods and high winds.

Between 5 December 2013 and 15 February 2014 there were twelve major storms, and other smaller ones. Sometimes there were only two or three days between them.

Homes, shops, and farmland were flooded as the rain swelled rivers around the UK. Strong winds pulled up trees, damaged buildings and bridges, and overturned cars and trucks. At least 250 000 homes were without electricity at some point, when power lines were blown down.

The storms brought travel chaos too. Many flights were cancelled, over those winter months. Roads were closed because of fallen trees, and flooding. Rail services were disrupted.

Along the coast, strong winds drove waves onto the land, causing sea floods. Storm surges added to the danger. In several places, waves swept chunks of cliff away. Some cliff-top homes slid into the sea.

Sadly, the storms brought death to fifteen people. One was a teenager, swept off a coastal path in Plymouth. Two people died trying to rescue their dogs from flooded rivers. In London, a woman was killed when part of a building collapsed onto her car.

▲ The wind blew this truck over. In some places, the wind speed reached over 150 km per hour.

▲ The storms moved across the Atlantic Ocean, from west to east.

◀ Because of the rain, the Somerset Levels (an area of flat land in Somerset) were flooded for many weeks.

What caused the storms?

They were all caused by one thing: the clash of warm and cold air masses.

Imagine you are looking down from above. You see a warm air mass meeting a cold one, over the Atlantic Ocean. How does a storm start?
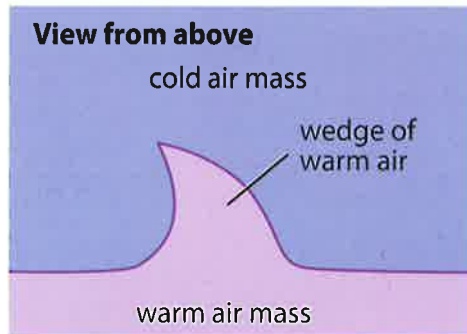
It starts when a wedge of warm air pushes into the cold air mass. The warm air rises. So air pressure falls. Cold air rushes in to replace the warm air, as strong winds.
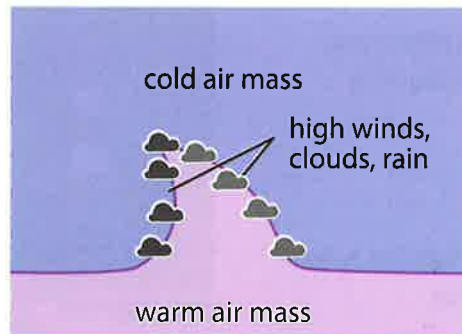
The warm rising air cools, and its water vapour condenses. So banks of cloud form. And then the rain begins. So now we have strong winds *and* rain.
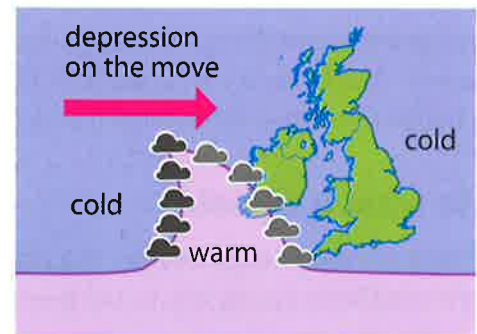
The resulting weather system is called a **depression**. It moves eastwards. It can take up to three days to cross the UK. And while it's crossing, we have stormy weather.

Why does a depression move?

A depression moves because it is dragged by a wind called the **jet stream**, which flows along at the top of the troposphere. (Since it's so high up, we don't feel it.)

A depression on a weather chart

The weather chart on the right shows a depression moving across the British Isles. The leading edge of the wedge of warm air is shown as a warm front. Cold air follows the wedge of warm air. So it is shown as a cold front.

In time, all the warm air will have risen and cooled, and the depression will die away.

Overall, a depression acts like a giant whisk. It is Nature's way of mixing warm and cold air masses.
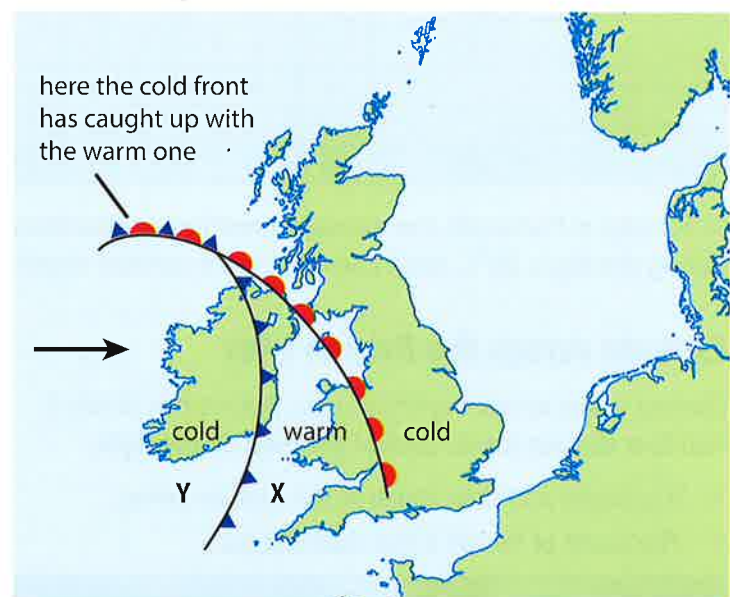
Your turn

1 Look at the first photo on page 80. The wind caused the truck to topple over. But what caused the wind?

2 The storms that arrived in the winter of 2013 – 14 did £1 billion of damage. List the kinds of things you think might have been damaged, or destroyed.

3 Imagine you are outdoors in the UK, in a wild storm. Where exactly in the UK are you? What do you see and feel?

4 Storms are quite common in the UK. Why?

5 a Name the weather system that brings us storms.
  b The storms usually start over the Atlantic Ocean, and move east across the UK. Why do they move?

6 Look at the weather chart above. It is warmer at X than at Y. Explain *why*.

7 Now explain what a depression is, as if to a 9-year-old.

From weather to climate

Here you will learn what climate is, and how to read a climate table, and a climate graph.

Weather: a reminder

Weather is the state of the atmosphere at a given time.

It was warm and dry in Plymouth, when this photo was taken – but it may have rained later. The weather can change from hour to hour and day to day.

So what is climate?

Climate is the *average* weather in a place. It tells you what the weather is *usually* like, in any given month.

To work it out, they take measurements every day, over a long period (usually 30 years). Then they calculate the average measurements for each month.

Look at this table for Plymouth:

▲ *A nice day in Plymouth – but what's the climate like there?*

Climate data for Plymouth												
(These are average values.)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum temperature (°C)	8	8	10	12	15	18	20	19	18	15	11	10
Rainfall (mm)	99	74	69	53	63	53	70	77	78	91	113	110
Hours of sunshine/day	1.8	2.9	4.0	6.0	7.0	7.3	6.7	6.5	5.2	3.4	2.7	1.6
Number of days with gales	3.4	1.9	1.5	0.5	0.3	0.1	0	0.3	0.9	1.3	2.2	3

So for July, in Plymouth, the average maximum temperature during the day is 20 °C. And November is the wettest month.

Climate across the British Isles

Climate varies across the British Isles. But we can divide it into four climate zones. Look at the map on the right.

- It is colder and drier towards the east, in winter.
- The south of the UK is the warmest part.

▲ *A meteorologist working on climate data.*

A **British Isles climate zones** N

mild summers mild winters, wet

mild summers cold winters, quite wet

warm summers cold winters, dry

London

Plymouth

warm summers mild winters, quite wet

A climate graph

The things we usually want to know about the climate in a place are:

◆ How hot or cold does this place get?

◆ Does it have a lot of rain?

We can show the answers on a **climate graph**.

Look at this climate graph for London. The red line shows temperature. The blue bars show rainfall.

For May, the maximum temperature is about 18°C. (Read it at X, the mid-point for May.) And May has about 50 mm of rainfall in total.

But remember, these figures are averages. They do not tell you what the weather will be like on any given day. For that, you need the weather forecast!

Maximum temp (°C)

London's climate

Monthly rainfall (mm)

London
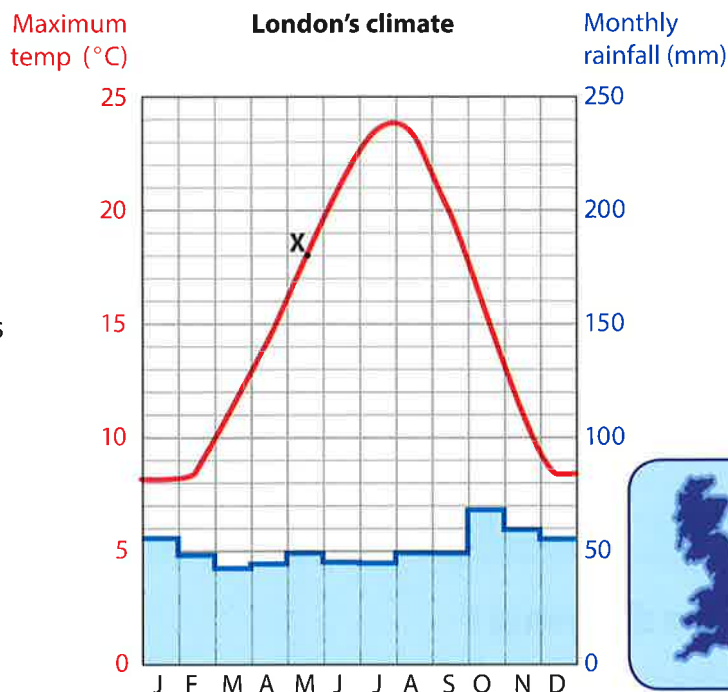
Your turn

1 What is the difference between weather and climate?

2 Look at each statement **A – F** below. Say whether it is about weather, or climate.
   A November is usually the wettest month in Plymouth.
   B It's usually very hot in Egypt, in August.
   C Last September, a terrible storm carried Richard's garden shed away.
   D May to September is the monsoon season, in South East Asia.
   E There was heavy fog on the motorway last night.
   F January is a good time to head for Florida, to catch some winter sun.

3 Look at the table for Plymouth, on page 82.
   a Which month usually has least sunshine?
   b Which month usually has most gales?
   c Which month is usually warmest?
   d You are planning to go on a camping holiday around Plymouth. First you have to choose the month.
      i Which month do you think would be best? Why?
      ii Which do you think would be worst? Why?

4 Look again at the table for Plymouth. It shows the *maximum* temperature. That means the temperature *at the warmest time of day*.
   a The warmest time of day is usually in the afternoon. See if you can explain why.
   b The temperature at night is several degrees lower. Why? Tell us!

5 Using map **A**, and the map on page 139, write a short description of the climate in:
   a Peterborough   **b** Belfast
   c Aberdeen   **d** Newport

6 Now look at the climate graph for London, above.
   a What does the red line show? (Check the red axis.)
   b **i** Which two months are usually hottest?
      ii About how hot do they get, on average?
   c **i** Which two months are coldest?
      ii What's the maximum temperature for those two months, on average?

7 Look at the blue bars on the climate graph.
   a What do they show? (Check the blue axis.)
   b **i** Which month is usually driest, in London?
      ii About how much rain falls that month?
   c **i** Which month gets most rain?
      ii About how much rain does it get?

8 Your cousin is flying to London next week, from Japan. She asks you if she'll need a raincoat. Will the climate graph help you to decide? Explain!

9 Now see if you can answer these questions about the climates in Plymouth and London.
   a Which place gets hotter in summer?
   b Which place gets colder in winter?
   c Which has the highest *total* rainfall for the year? Explain how you worked out your answer.
   d Do your answers for **a** – **c** fit with map **A**? Explain.

The factors that influence climate

Here you will learn why climate varies so much from place to place.

Different climates

Climate is what the weather is usually like in a place, in a given month. It can be very different in different places, and in different months. Look at this table:

Place	Month	Average max temp (°C)	Average precipitation (mm)
North Pole	August	0	15 (snow)
Ndjamena, Chad	August	32	174 (rain)
London, UK	August	23	50 (rain)
London, UK	December	8.5	55 (rain, snow)

Why the difference?

Why is climate so different in different places, and in different months? Let's look at the factors that influence it.

1 Latitude – the main factor

Latitude means how far a place is from the Equator. It is the main factor that dictates climate.

The diagram on the right shows the Sun shining on Earth. Look at the rays labelled **A**. They strike an area around the Equator. Their energy heats the ground. Then the ground heats the air.

Look at **B**. These rays strike a larger area, because Earth is curved. So there's less energy per square km. So it doesn't get as hot.

Look at **C**. These rays strike an even larger area. It hardly warms.

So the curve of Earth is the reason why …

- it is always very cold at the North and South Poles.
- the UK is always colder than Chad.
- the north of the UK is cooler than the south.

2 Earth's tilt plays a big part too

Earth travels non-stop around the Sun. It is tilted as it travels. A full orbit takes a year.

That tilt is the reason why our climate in the UK changes through the year. It gives us our **seasons**.

Look at the diagram. In June, the top half of Earth, where we live – the **Northern Hemisphere** – is tilted *towards* the Sun. So we get more heat. We have summer.

But by December, it is tilted *away* from the Sun. So we get less heat. It's winter!

▲ In Ndjamena, the capital city of Chad (in Africa).
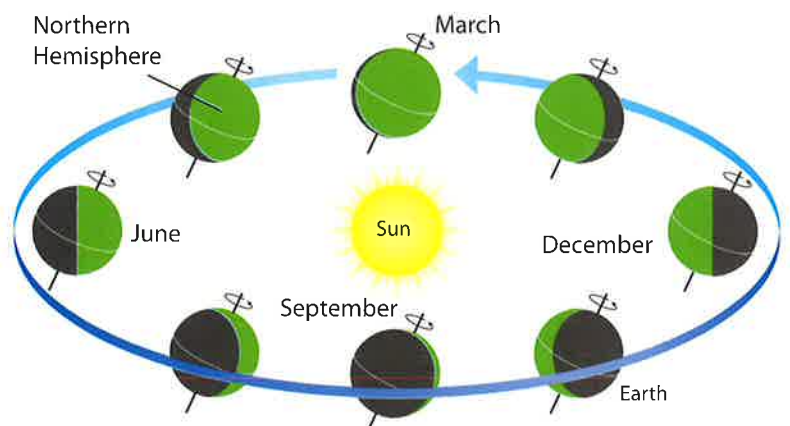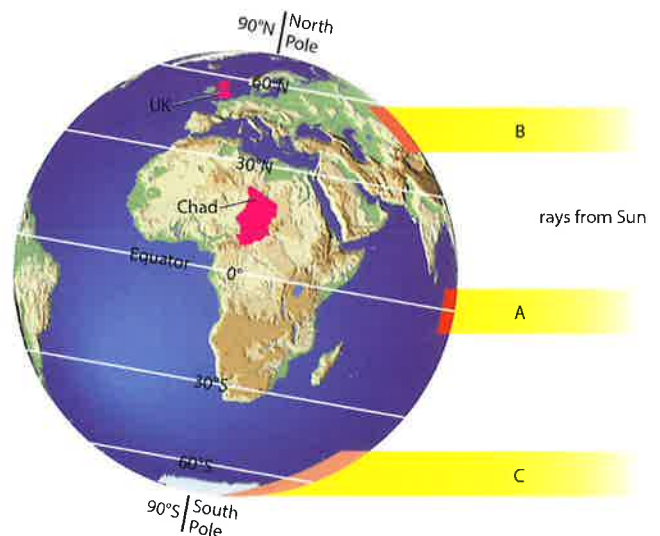
3 Four other factors

Here are four other factors which affect the climate in a place.

cool sea breeze

sea cooler than land in summer

Distance from the coast
The sea is cooler than land in summer, and warmer in winter. So a sea breeze keeps the coast cool in summer – and warm in winter!

N

wind from south west
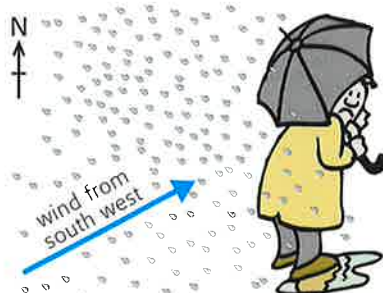
Prevailing wind direction
For example in the UK the prevailing wind is from the south west. It brings water vapour from the ocean – and that means rain!

Did you know?
◆ Winds and ocean currents are Nature's way of spreading heat around.

Why...
◆ ... does it get cooler as you go up a mountain?

North Atlantic Drift

Atlantic Ocean

Ocean currents
For example a warm ocean current called the **North Atlantic Drift** warms the west coast of the UK in winter, by warming the wind.

snow even in summer!

Ben Nevis – Scotland's highest mountain   1344 m

Height above sea level
Or **altitude**. The higher you are above sea level, the cooler it is. The temperature falls by about 1 °C for every 100 metres.

It's complex!

All those factors play a part in climate. So it is a complex balance. For example, half of Chad is in the Sahara Desert, so is very dry. But the capital, Ndjamena, gets over three times more rain than London does.

Are we nearly there?

▲ Mt Kilimanjaro, in Africa, is near the Equator. But it has snow on top – and glaciers! Its altitude: 5895 m.

Your turn

1 Draw a spider map to show the factors that influence climate. Make it look interesting. (Add little drawings?)

2 Explain these terms:
   a latitude   b altitude   c prevailing wind direction

3 Using the map on page 139, give two reasons why:
   a Aberdeen is colder than Plymouth in winter
   b it's colder up Ben Nevis than in Plymouth

4 Use the world map on pages 140 – 141 to help explain why Tehran (Iran) is hotter than Lisbon (Portugal), in summer.

5 From the same map, choose the capital city you think might be coldest in December. Explain your choice.

6 Here are the answers. What are the questions?
   a *Because the sea heats up more slowly than land does.*
   b *Because the sea cools down more slowly than land does.*

7 In the UK, the *prevailing wind* is a south west wind.
   a What does this mean? (Glossary!)
   b Explain how this wind affects the climate.
   c How would a prevailing *north* wind affect our climate?

Climates around the world

Here you will see how climate varies around the world, and then give reasons why.

A world climate map
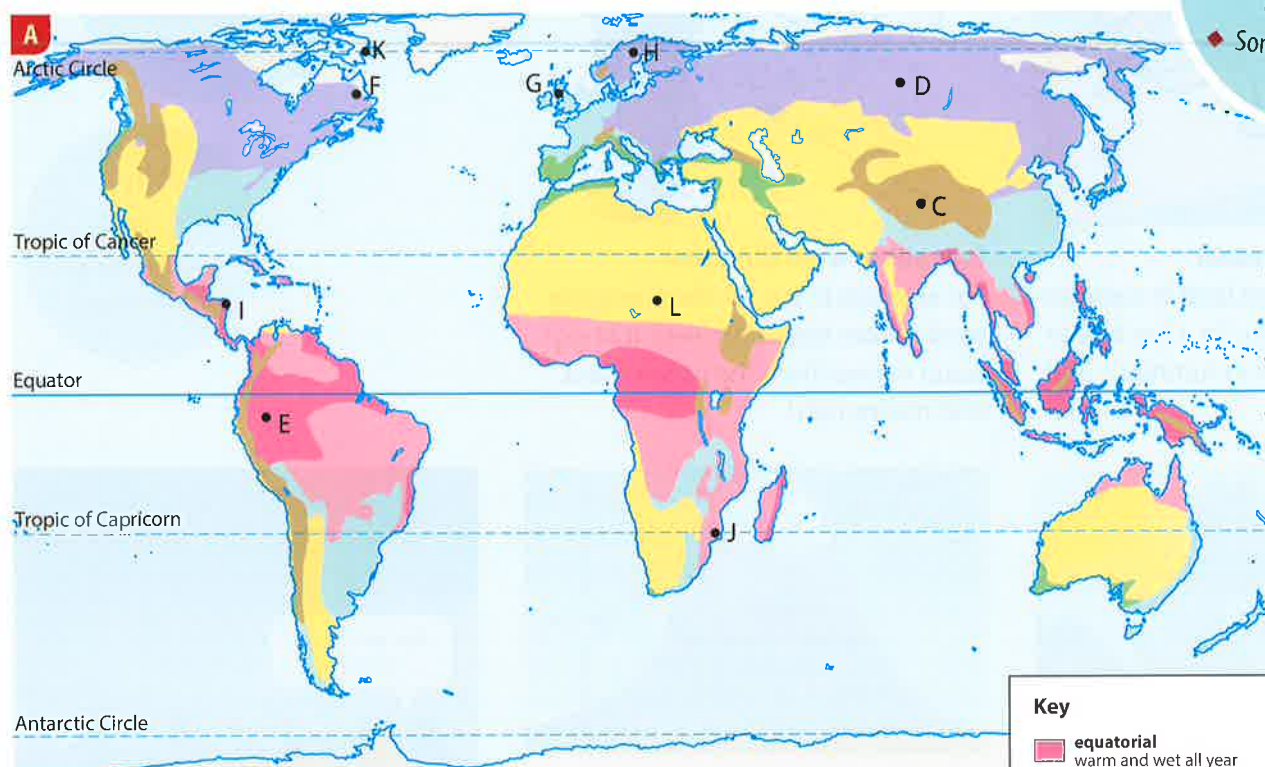
A

Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
Antarctic Circle

Key

	equatorial warm and wet all year
	tropical hot and wet, with a dry season
	desert very dry, with very hot summers and cooler winters
	mediterranean hot dry summers, warm wet winters
	maritime warm summers and cool winters, wet
	continental warm summers and cold winters, wet
	polar very cold all year (especially in winter), and dry
	mountain cold because it is high, with heavy rain or snow

This map shows Earth's different **climate regions**. The differences are due to the factors you met in Unit 5.9.

Look at the darker pink region around the Equator. The key shows that it's warm and wet here all year. It is always warm because the Sun shines straight at it. It is wet because the warm air rises fast, the water vapour condenses to form thick clouds – and then the rain pours down.

But note that this region is not the *hottest*, even though it is at the Equator. That's because the thick clouds stop some sunlight getting through. The clouds have a cooling effect during the day.

The climate varies within regions

The map shows that the British Isles are in a region of warm summers and mild winters, with rain all year.

This does not mean that every part of the British Isles has the same climate. But *overall*, our climate is mild, and quite damp.

50 years from now …

50 years from now, a world climate map may look different, since Earth is getting warmer. Find out more in Chapter 6.

Your turn

1 Look at map **A** on page 86. What's the climate like at:
   a L?   **b** D?   **c** E?   **d** J?

2 Look again at map **A**.
   a It is a lot cooler at **D** than at **L**. Suggest a reason.
   b It is a lot hotter at **J** than at **F**. Why?

3 Latitude is the main factor that influences climate. But it is not the only one. See if you can list four other factors, *without* looking back at pages 84 – 85.

4 The Sun heats Earth unevenly. Nature spreads some of the heat around, via winds and ocean currents. Map **B** shows *some* wind directions, and ocean currents. It also shows some mountain ranges.
   a What are ocean currents? (Glossary?)
   b The warm current to the west of the UK is called …?
   c **i** Name a country which may be affected by a cold current. The map on pages 140 – 141 will help.
       ii How might the cold current affect it?
   d Now name a country where the prevailing wind is:
       i from the south east   **ii** from the north west

5 Here are some facts about places marked on map **A**. See if you can explain them. Map **B** will help.
   a It is cold all year round at **C**.
   b **G** is at the same latitude as **F**, but is warmer.
   c **K** is at the same latitude as **H**, but is colder.
   d It is drier at **L** than at **I**, and hotter in the daytime.

6 Now look at this climate graph. It is for a place called Frobisher Bay.

Climate graph for Frobisher Bay
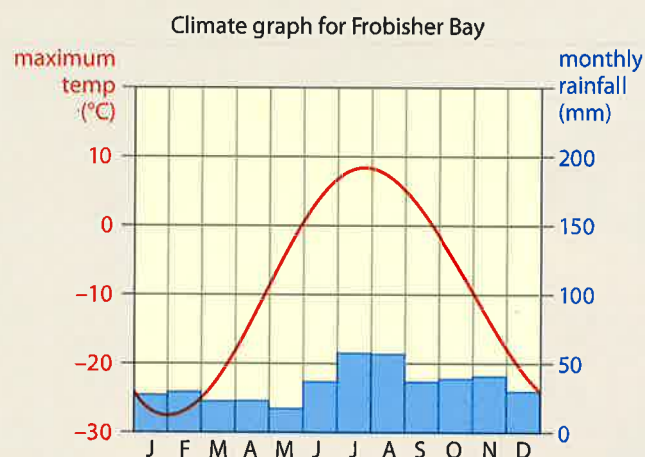
   a Which two months are warmest, in Frobisher Bay?
   b Which month is driest?
   c In which months can the residents expect snow?
   d Overall, how does this climate compare with London's climate? (See page 83.) Write *at least* 35 words in your answer. You must include some data, as evidence!

7 Frobisher Bay is shown by a letter on the map on page 86. Which of these letters is it: **G**, **J**, **K**, or **L**?
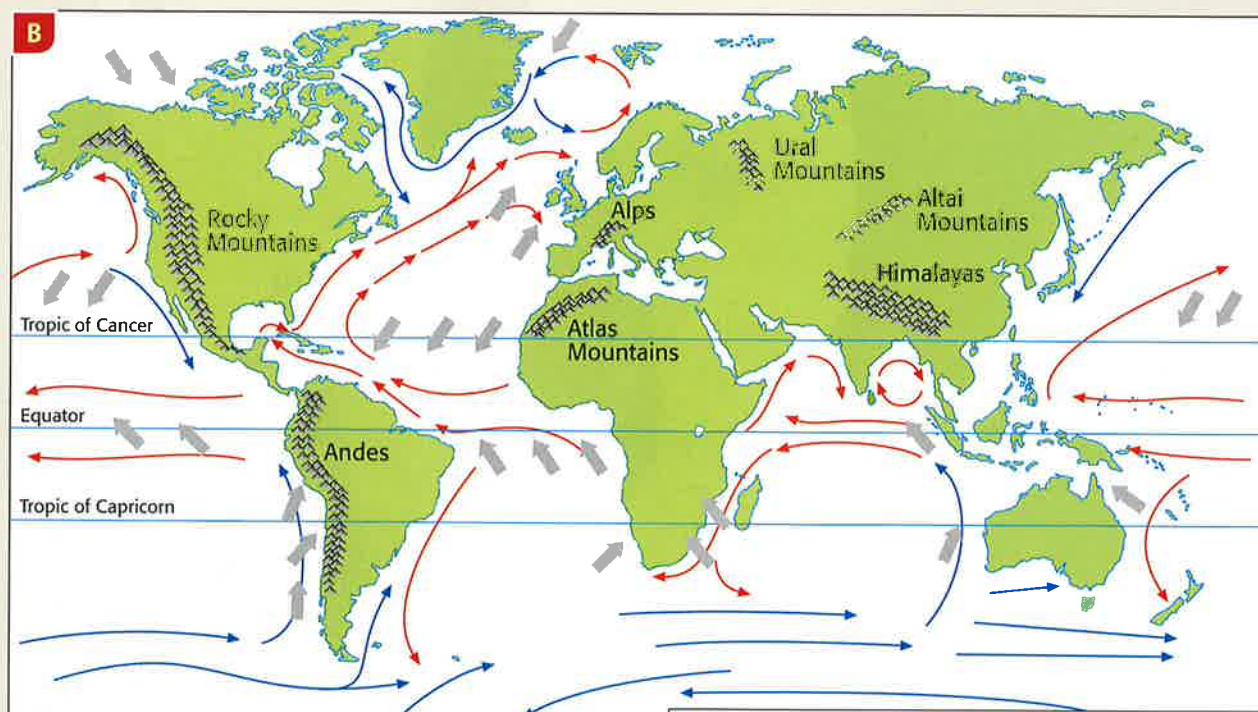
Key

▲▲▲▲ mountain range	warm ocean current
prevailing wind	cold ocean current

The big picture

This chapter is about **global warming**. Here's the big picture …

◆ Temperatures around the world are rising. We call it global warming.

◆ Some scientists say it's a natural change.

◆ But most say it's due mainly to carbon dioxide, the gas that forms when we burn fuels.

◆ Rising temperatures bring changes in rainfall, and wind patterns, and ocean currents. In other words, **climate change**.

◆ Climates are changing around the world already.

◆ We can take action to limit the amount of carbon dioxide we produce.

Your goals for this chapter

By the end of this chapter you should be able to answer these questions:

◆ How have temperatures changed since the end of the last ice age?

◆ What do these terms mean?
global warming   *climate change*

◆ How will climate change affect our world? (Give at least six predictions.)

◆ How will climate change affect the UK? (Give at least four predictions.)

◆ What are greenhouse gases, and which two can I name?

◆ Carbon dioxide is the greenhouse gas that concerns us most. Why?

◆ When we burn fuels, we affect people in other countries. Why?

◆ What can I do, on my own, to help reduce carbon dioxide emissions? (Give at least four things.)

◆ What could: **i** governments do   **ii** scientists do
to reduce carbon dioxide emissions? (Give at least two things for each.)

And then …

When you finish the chapter, come back here and see if you have met your goals!

Did you know?
◆ If Greenland's ice sheet melts, sea levels will rise by about 6 metres.

Did you know?
◆ If the Antarctic ice sheet melts, sea levels will rise by about 60 metres.

Why…
◆ … are polar bears white?

Did you know?
◆ If the average global temperature rises by 4 °C from now, up to 70 % of species may become extinct.

What if…
◆ … the sun stopped shining?

Your chapter starter

Look at the photo on page 88. It was taken in London.

What are these people doing?

Why are they dressed as polar bears?

What do they want to happen? And why?

They are standing outside somewhere special. Where?

Can we go somewhere cooler?

Earth's temperatures through the ages

Earth has been cooling down and warming up ever since it formed. Find out more here.

Not like it used to be!

Today, some places on Earth are hot. Others are covered in ice. But it was not always so.
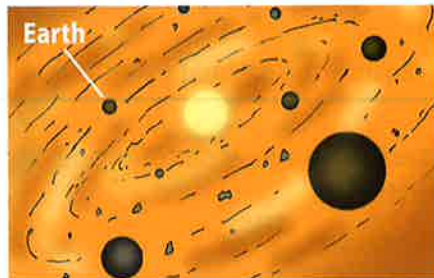
When it first formed, 4.5 billion years ago, our planet was very very hot, and soft. No ice anywhere.

Earth gradually cooled. Its surface hardened to a crust, and its atmosphere developed.

Since then, it has warmed up and cooled down many times. For example, 650 million years ago …
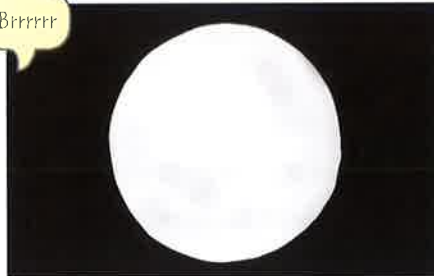
… when the only living things were cells, Earth was completely covered in ice. We call it **Snowball Earth**.
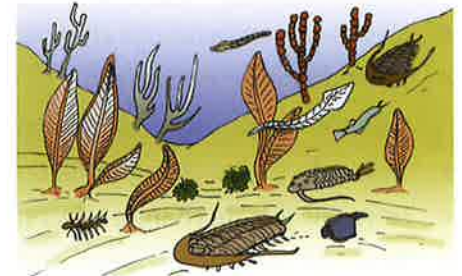
After the ice melted, and Earth warmed, evolution got a move on. More and more species appeared.
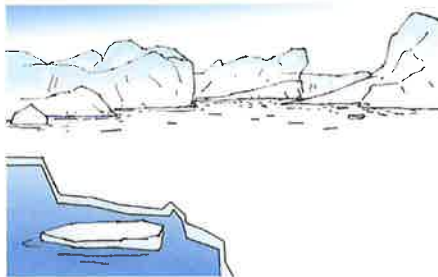
But other ice ages followed – and life suffered. Species that could not adapt to the cold were wiped out.

However, *most of the time*, Earth was ice-free! There was no ice at all when the dinosaurs ruled.

Our last ice age began 110 000 years ago. At its peak, ice covered 30% of Earth, including …

… the north of Britain. And the southern part became tundra, where not much could grow.

So the people who had been living here left, to look for food and warmth in other parts of Europe.

The ice age lasted 100 000 years. It ended 10 000 years ago. Today, ice covers only 10% of Earth.

Temperatures since the last ice age

We have kept temperature records since only 1850. But scientists can tell a lot about earlier temperatures by studying things like:

- sediment from deep in the floors of lakes and oceans
- ice from deep in the ice sheets of Antarctica and Greenland
- tree rings in the wood of ancient trees.

This graph shows what they found. It gives the average temperature in the Northern Hemisphere, for the last 11 000 years. Notice how it keeps changing! Then read the notes about points A – E on the graph.

What's happening to our ice?

Today, the temperature is rising. How will it affect us – and polar bears? You'll find out in later units.

Cool!

Brrrr, a cold dip. This one is called the Little Ice Age. The River Thames freezes over in winter, some years.

Here we go again.
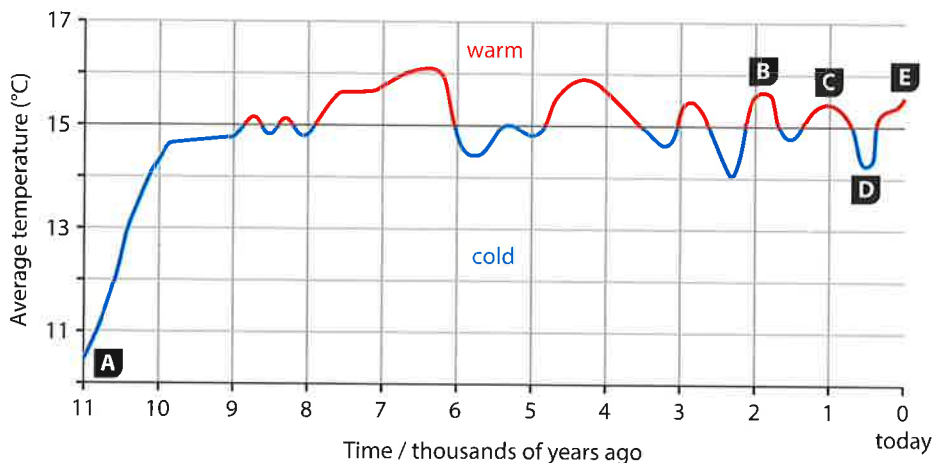
At this point on the graph, 11 000 years ago, the ice is melting. People are returning to Britain again.

It's warm enough to grow grapes, here in Britannia.

The bumps on the graph are warmer periods. B occurs in the time of the Roman Empire.

No pillaging for us.

We're farmers.

This bump is the Medieval Warm Period. The warmth allows Vikings to settle in parts of Greenland.

Your turn

1 True or false? If false, write a correct sentence in its place.
   A Ice sheets have never reached the Equator.
   B Dinosaurs drank from springs fed by glaciers.
   C The UK is in the Northern Hemisphere. (Glossary?)
   D Temperatures in the UK have always been much the same as today.

2 Look at the graph above. Over the last 11 000 years …
   a when was it coldest in the Northern Hemisphere? What was happening to the ice age at that point?
   b has it ever been warmer than today? Give your evidence.
   c what was the difference, in degrees, between the lowest and highest temperatures?

91

Global warming

Today, temperatures around Earth are rising. Find out more here.

It's getting warmer

Today, temperatures around Earth are rising. We call it **global warming**. Look at this graph. The red line shows how the temperature has changed since 1850, relative to an average. It zig-zags, but the trend is upwards.

Why do temperatures change?

Temperatures around Earth have been changing for billions of years. Many factors play a part. Here are three important ones:

- **greenhouse gases.** Some gases act like a warm blanket around Earth, keeping heat in. We call them greenhouse gases. They occur naturally in the atmosphere, but we also add some extra.
- **changes in Earth's tilt, and its path around the Sun.** These changes occur in cycles.
- **changes in the amount of energy the Sun gives out.** These changes occur in cycles too.

So what's causing global warming today?

Scientists have studied all the possible causes, including the three above. And this is their conclusion:

Temperatures are rising much faster than in the past.
We don't think this is natural.
We think the main cause is the greenhouse gases
which we are adding to the atmosphere.
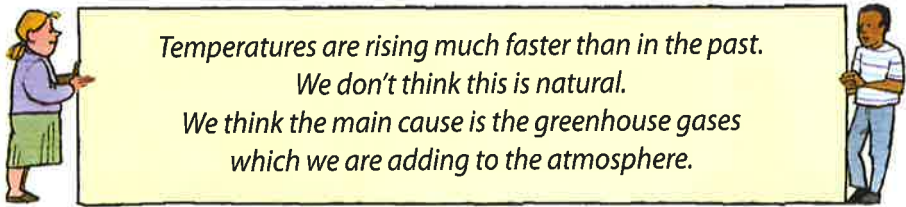
But not all scientists agree. Some think the warming is (mainly) natural.

How do greenhouse gases work?

Follow the numbers.

▲ *Changes in global temperature relative to the average for 1961 – 1990.*

▼ *Earth's path around the Sun changes in cycles, over time.*

from almost circular ...   ... to this
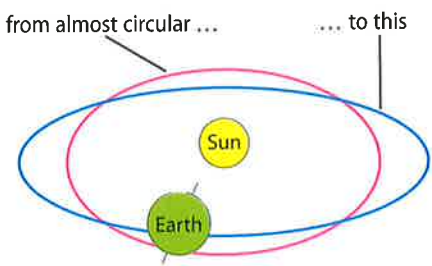
Did you know?
- They think Snowball Earth (page 90) was due to a big reduction in greenhouse gases in the atmosphere.

1 The sun sends out energy as sunlight. This warms Earth.

2 Earth gives out some of the energy again as heat, which warms the air.

3 Some of this heat escapes to the outer atmosphere.

4 But some is absorbed by the molecules of greenhouse gases.

5 So the air gets warmer and warmer. Average temperatures rise.

ATMOSPHERE

greenhouse gases

EARTH

Did you know?
- Without greenhouse gases, Earth's average temperature would be about -18 °C.

We need greenhouse gases. Without them, *all* heat would escape from Earth, and we'd freeze at night. But now we think we have too much of them!

The two main greenhouse gases

Here are the two main greenhouse gases which we add to the air.

Carbon dioxide, CO$_2$ Most scientists think this is the main culprit.

Thanks for that.
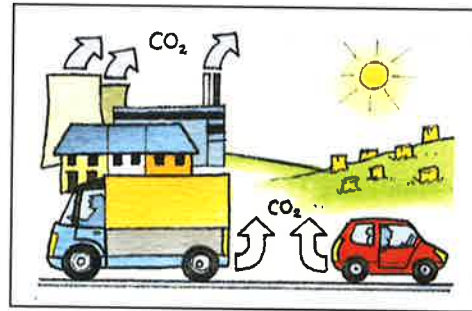
We breathe out carbon dioxide.
Trees and other plants take it in.
It used to be in balance, in the air.
But we add extra, when we burn …

… coal, oil, gas, and petrol. We also chop down trees, and build on the land. So there is less vegetation to take in the carbon dioxide.
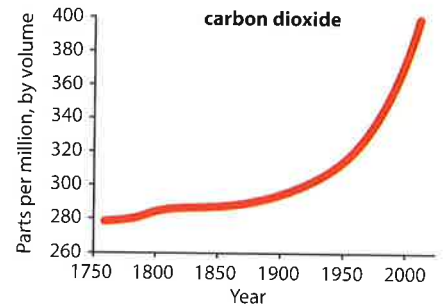
In fact the level of carbon dioxide in the atmosphere has been rising since the Industrial Revolution began, over 250 years ago.

Methane, CH$_4$ Look where this comes from.

Those two are so rude!
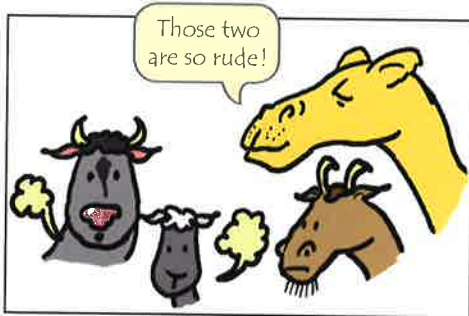
Cows, sheep, goats, camels – and other animals that 'chew the cud' – belch out methane.
(We think dinosaurs did too!)

Methane is also given off from swamps, and paddy fields, and landfill sites. Some escapes from oil and gas wells, as 'natural gas'.
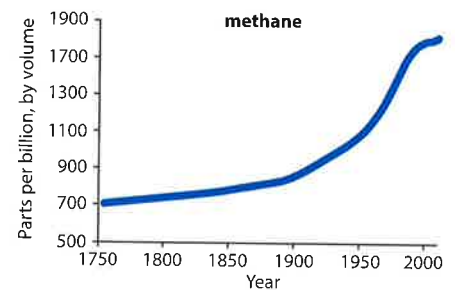
Every year, we raise more animals, grow more rice, extract more oil and gas, and bury more rubbish. So the methane levels keep rising.

Methane is a powerful warming gas. But we pump far more carbon dioxide into the atmosphere. (Look at the vertical axes on the graphs.) So we will concentrate on carbon dioxide for the rest of this chapter.

Your turn

1 a What does the term *global warming* mean?
   b Give two examples of changes that we have no control over, which can affect global temperatures.
   c Most scientists think that we humans are *causing* global warming. Explain this, with examples.

2 Copy and complete these statements.
   a We'd die without greenhouse gases, because …
   b Greenhouse gases can harm us, because …
   c The two main greenhouse gases are …

3 The level of carbon dioxide in the atmosphere has been rising since the Industrial Revolution began. See if you can explain why. (Will the glossary help?)

4 Look what they think. What will you say in reply?
   a *Greenhouse gases? Nothing to do with me!*
   b *Nor me!*

As temperatures rise, Earth's climates will change. Find out more here.

How warm will it get?

Scientists say our atmosphere will keep on getting warmer.
Map **A** shows one set of predictions, for up to the year 2050.
The deeper the shade, the bigger the temperature change.

A **How much temperatures may rise, between 2000 and 2050**

Temperature rise (°C)

Temperature rise scale: 6, 5.5, 5, 4.5, 4, 3.5, 3, 2.5, 2, 1.5, 1, 0.5, 0
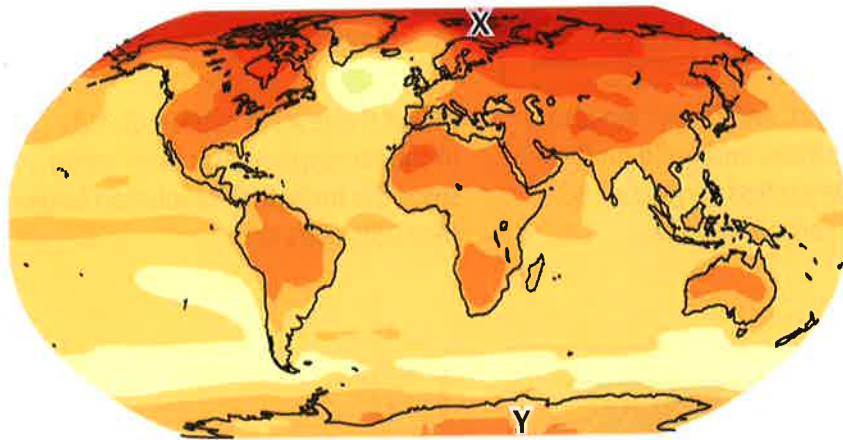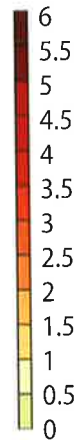
- The biggest change will be around the Arctic. Look at **X** on the map. *It will still be cold there* – but quite a bit warmer than today.
- There will be warming in Antarctica too. Look at **Y** on the map.
- The Northern Hemisphere will warm more than the Southern Hemisphere. That's mainly because it has more land.

A rise of 4° or 5°C may not seem much. But think about this. Earth's average temperature today is only about 4.5 °C higher *than it was in the last ice age*.

Did you know?
- The average global temperature in 2000 was 15.6 °C.
- A rise of 6 °C above that would kill off billions of humans.

Climate change

As the temperature rises, the patterns of rainfall, and wind, and ocean currents, will change too. In other words, **climates** will change. We will all be affected. Look at some of the things that will happen:

1 Some places will get much more rain, and some much less, than now.

2 There will be more extreme weather events: heatwaves, droughts, storms, and flooding.

3 Ice sheets in Greenland and Antarctica will show melting. Mountain glaciers will melt too.

4 Sea levels will rise because of melting ice – and because water expands as it warms.

5 Rising sea levels means low-lying coastal places will flood more often – and may even drown.

6 Some places will get too hot and dry to grow crops. This will cause famine.

7 Some places will be able to grow new crops that they could not grow before.

8 Animals and plants that can't cope (by moving, or adapting) will die out.

9 Diseases will spread, as insects and animals that carry them move to new places.

10 There will be millions more refugees, as people flee from floods, or drought and famine.

What about the UK's climate?

Here is what's predicted for the UK. Get ready!

We'll have more hot summer days. Summer will last for longer. There will be fewer very cold winter days. Snow might be rare.

But winters will be wetter than now. Summers will be drier overall, but with sudden heavy downpours, which will cause flash floods.
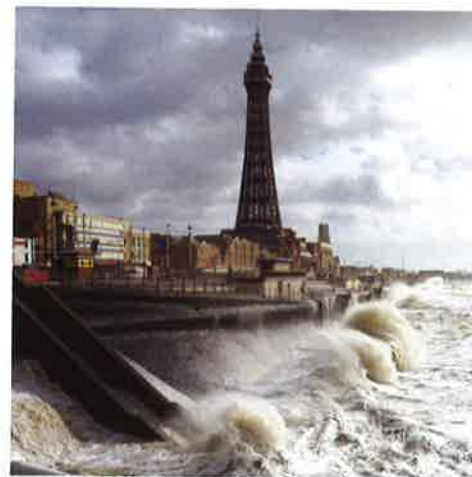
Expect more extreme events: heatwaves, drought, gales, and storms. There will be more flooding too, by rivers and the rising sea.

In fact these changes have started already. They will continue, and deepen.

▲ As the UK warms, farmers may start growing things like peaches, kiwi fruit, sweetcorn, and sunflowers (for sunflower oil). But drought could be a big problem in summer.

▲ Birds like this hoopoe, from warmer places, are likely to breed in the UK. British birds like the red grouse, which need a colder climate, may live only in the Scottish Highlands.

Your turn

1 Look at map **A**. It shows how much temperatures may have risen by 2050, compared with 2000.
  a What age will you be by 2050?
  b Will the temperature rise be the same everywhere?
  c Where will the temperature change most?
  d Look at **Y** on the map. It is in Antarctica. By about how much will the temperature rise at **Y**?

2 Look at the consequences of climate change, in the boxes on page 94. Which do *you* think is the worst one? Why?

3 True or false? Give reasons. (Do you need the glossary?)
  A Climate change will have social consequences.
  B Climate change won't have any economic consequences.
  C Nobody will benefit from climate change.
  D Rising sea levels won't affect the UK.

4 The climate is changing in the UK.
  a List: **i** the positive changes **ii** the negative changes
  b Overall, do you think climate change will improve life in the UK by 2050, or make it more difficult? Explain.

It's happening already!

Climate change is already affecting humans, and other species. Find out more here.

Climate change is here

People are still arguing about the causes of climate change. But most people agree that it is underway already.

Below are some examples of its impact around the world.

Places, people, plants, animals – all are being affected.
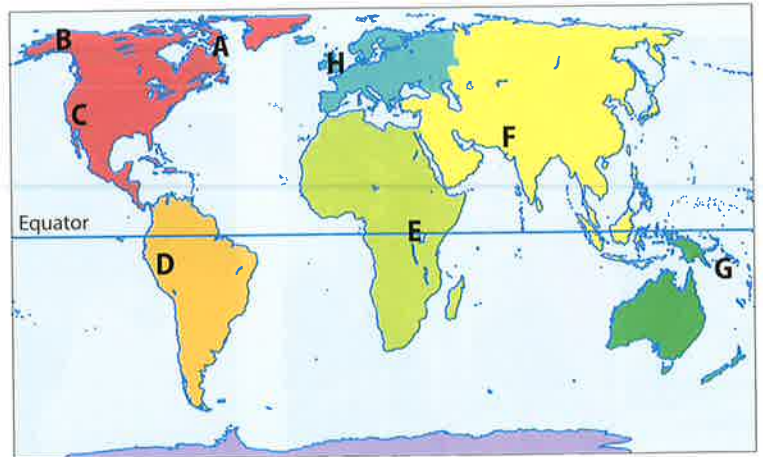
In the Arctic Ocean, more sea ice is melting each year, and earlier. That's bad news for polar bears, who use it as a platform for hunting seals. Less ice means they must swim further for their food – or starve.

In the **tundra**, soil below the surface is usually frozen all year. It's called **permafrost**. But now it is starting to thaw. So buildings shift and tilt. And the methane trapped inside the permafrost escapes into the air.
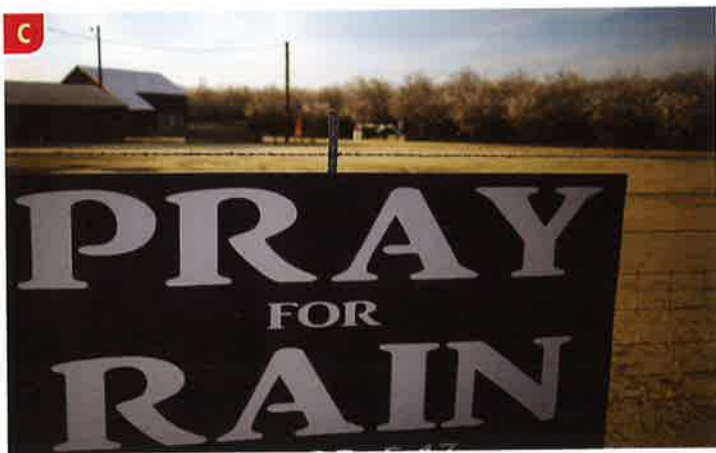
The southwest of the USA often has droughts. Now they are more severe, especially in California (where this photo was taken) and Texas. Crops shrivel. Farmers, homes, and businesses, compete for a limited supply of water.

Rivers in Peru are fed by glaciers up in the Andes mountains. These glaciers are shrinking very fast. So river levels are falling, and Peru is already suffering from water shortages.

Most people in Africa depend on farming. But rainfall patterns are changing. Both drought and floods are becoming more common. Here in Uganda, farmers say it's really hard to decide when to plant.

Wheat is a major world crop. Here in Pakistan, as in many other countries, wheat yields are falling thanks to climate change. So prices of foods made from wheat are rising … including in a shop near you.

Water levels are rising in the Pacific Ocean faster than anywhere else. Low flat island countries like Tuvalu (population 11 000) are now flooded very often. The ocean may have covered Tuvalu by 2100.

These are just a fraction of the changes taking place already. The changes will continue, and deepen, long into the future.

Changing climates are changing wildlife patterns. For example here in the UK, frogspawn is hatching earlier. And the Brown Argus butterfly is spreading north to places which were once too cold for it.

Your turn

1 The places in the photos are marked on the map on page 96. For each place, name the continent it's in.

2 a What is *permafrost*?
  b The thawing of the permafrost is likely to speed up global warming even more. Explain why.

3 Chose one of the photos. Write a short report for a newspaper about the impact of climate change it shows. 50 words?

4 Now imagine you are one of these two living things:
  a a polar bear   b a Brown Argus butterfly
  Write down your feelings about climate change.

5 And finally, draw a big spider map with this title: *Impacts of climate change.*
  Use it to summarise what you have learned so far. Chose suitable headings. For example *On people, On wildlife, On the physical world.*

The world's poorest people will suffer most from climate change. Find out more here.

The impact on poorer countries

People in many poorer countries, in Africa and Asia, will be badly hit by climate change. They will have drought, and crop loss, and flooding.

It costs a lot to help people cope with these events. Poor countries don't have much money to spend. So their people will suffer most.

It's not fair!

Poor countries will suffer most – but the richer countries have pumped most carbon dioxide into the atmosphere over the years. And most scientists say it's the main culprit.

Carbon dioxide forms when we burn fuels – coal, oil, gas, petrol, diesel, kerosene, and wood. (They all contain carbon.) Now look:

Did you know?
◆ Two billion people around the world depend on firewood and animal dung, for their cooking.

Why...
◆ ... doesn't carbon dioxide escape into outer space?

1 We burn **coal**, **oil** and **gas** in **power stations**, to make electricity for our homes.

So when you turn on a light, or charge your mobile, you are burning a fossil fuel indirectly.

4 We burn kerosene in plane engines, to fly from place to place. (It's made from oil too.)

2 At home, we burn gas for heat, and cooking. And some people like coal fires.

3 We burn **petrol** and **diesel** (made from oil) in car and bus engines.

5 But many people in poorer countries don't have electricity, or cars, or cookers. They use very little fuel: only **firewood**.

Comparing carbon dioxide production

Look at bar graph **A**. It shows the average amount of carbon dioxide produced *per person* in ten different countries, in 2012.

A person in the UK produced about 19 times more that year, on average, than a person in Ghana. A person in the USA produced over twice as much as someone living in the UK.

The amounts change from year to year. For example, they are rising fast for China, because it is developing fast. People are buying more cars, and computers, and dishwashers, and air conditioners.

(China produces carbon dioxide on our behalf too, because its factories use fuel to make lots of things we buy.)

A

Carbon dioxide production per person in 2012

Countries (top to bottom): Ghana, India, Indonesia, Italy, China, UK, Japan, Germany, South Korea, USA

Average amount per person (tonnes) — scale 0 to 18
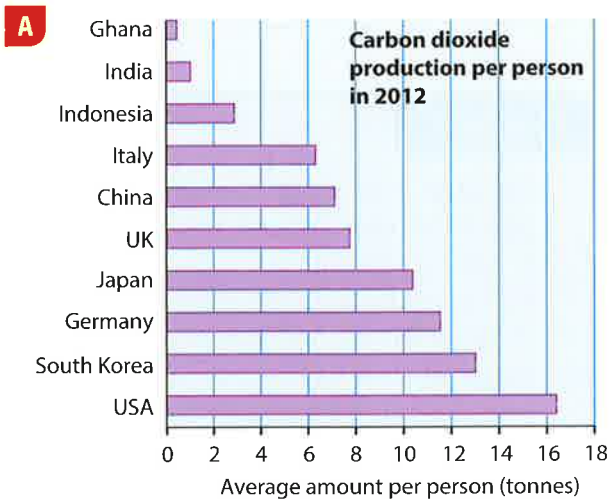
The trouble is …

Poorer countries produce less carbon dioxide *per person*.
But this does not help them to escape climate change. Look.

lots of carbon dioxide

ATMOSPHERE

the carbon dioxide spreads

EARTH

Who will rescue us?
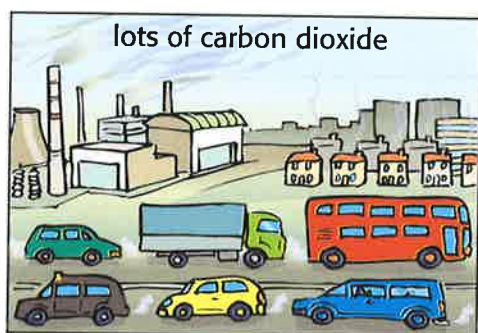
When we burn fuels containing carbon, the carbon dioxide gas goes into the air. But it does not hang around in one place.
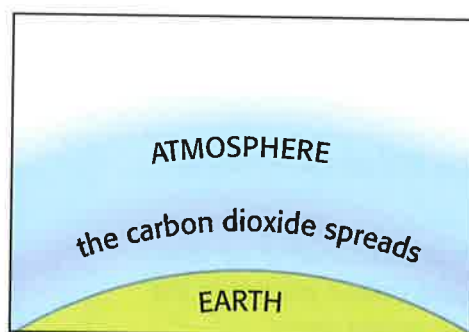
It is carried away by the wind, and it spreads through the lower atmosphere. So its warming effect is felt everywhere.

The result is that people in poorer countries, who use very little fuel, still suffer from the effects of global warming.

Local actions, global effects

So, when you leave the light on in your room, or the TV on standby, you may be affecting someone far away, on the other side of the world. It's an example of **local actions, global effects**.

Did you know?
◆ Oil, coal, and gas together provide about 80% of the world's energy.

Your turn

1 How much do you depend on burning fuels? Let's explore.

a
> Things I do on a typical school day
> get up
> turn light on
> take shower
> dry hair
> eat cornflakes
> catch bus to school

Make a list like this for your typical school day. Fill in the main things you do.
(Do you phone a lot? Or go on the computer?)

b Now underline any activities that depend on burning fuels. Think carefully! (For example, turning the light on links you to a power station, where a fuel is burned.)

c Look at the things you underlined. Use two different ways to mark the ones where the fuel is burned:
  i where you are (for example, gas for heating at home)
  ii somewhere else (for example, in a power station)
You could use * and ** for example. Then add a key to explain.

2 Look at your list. Do you depend a lot on burning fuels? Draw a scale like this, and mark an **X** on it, for you.

How much do I depend on burning fuels?

1	2	3	4	5
not at all		quite a lot		for everything
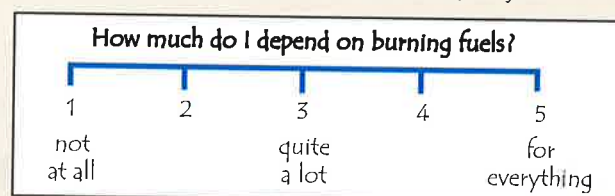
3 Look at the bar graph on page 98.
a Which of the ten countries produced most carbon dioxide per person, in 2012? See if you can explain why.
b Which produced least? Try to explain this too.
c About how many times more did a person in the UK produce than a person in India?
d In 2012, China had 1350 million people. The UK had 64 million. Using the bar graph, see if you can work out a rough figure for the *total output* of carbon dioxide that year for:
  i China **ii** the UK

4 Copy and complete these sentences:
a 'Local actions, global effects' means …
b The burning of fossil fuels is an example of 'local actions, global effects' because …

So what can we do?

In this unit you'll find out whether we can stop global warming. If we can't stop it, what *can* we do?

Can we stop global warming?

No.

Suppose most scientists have got it wrong, and global warming is only natural. Then we can't stop it.

But if we *are* causing it ... we still can't stop It. Not even if we stop burning fuels this minute. Because the extra carbon dioxide in the air already will hang around for at least a hundred years.

But we *can* cut back on the amount we produce now, to limit the temperature rise in the future.

Are we doing that? No. Every year, the world produces *more* carbon dioxide than the year before. One reason is that most governments are unwilling to limit people's fuel use.

The trouble is, if we don't cut back, temperatures may spiral out of control. We can't predict what will happen. But if the average global temperature rises by 6°C, we probably won't survive.

Meanwhile, climate change will carry on for now. So we must adapt to it. For example, we can plan how to cope with drought.

We must take action. Why are we waiting?

World carbon dioxide emissions from burning fossil fuels
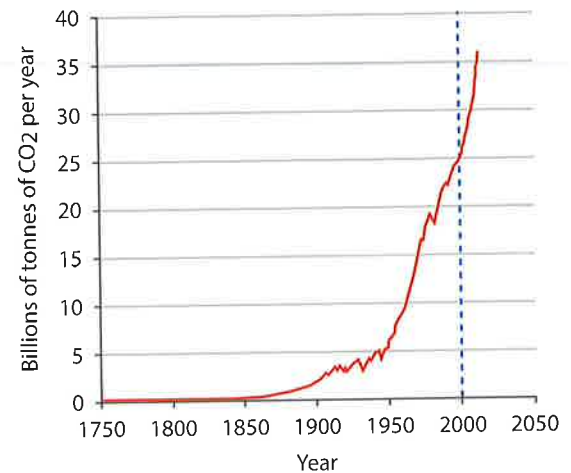
What if...
- ...it got so hot that all the rainforests died?

What if...
- ...most of our planet got too hot to live on?

Some options

Here are some options for what to do. What do you think?

A Do nothing. Just carry on as we are.

B Find ways to remove carbon dioxide from the air.

C Reduce the amount of carbon dioxide that's produced.

D Stop some sunlight from reaching Earth.

E Help people to adapt to their changing climates.
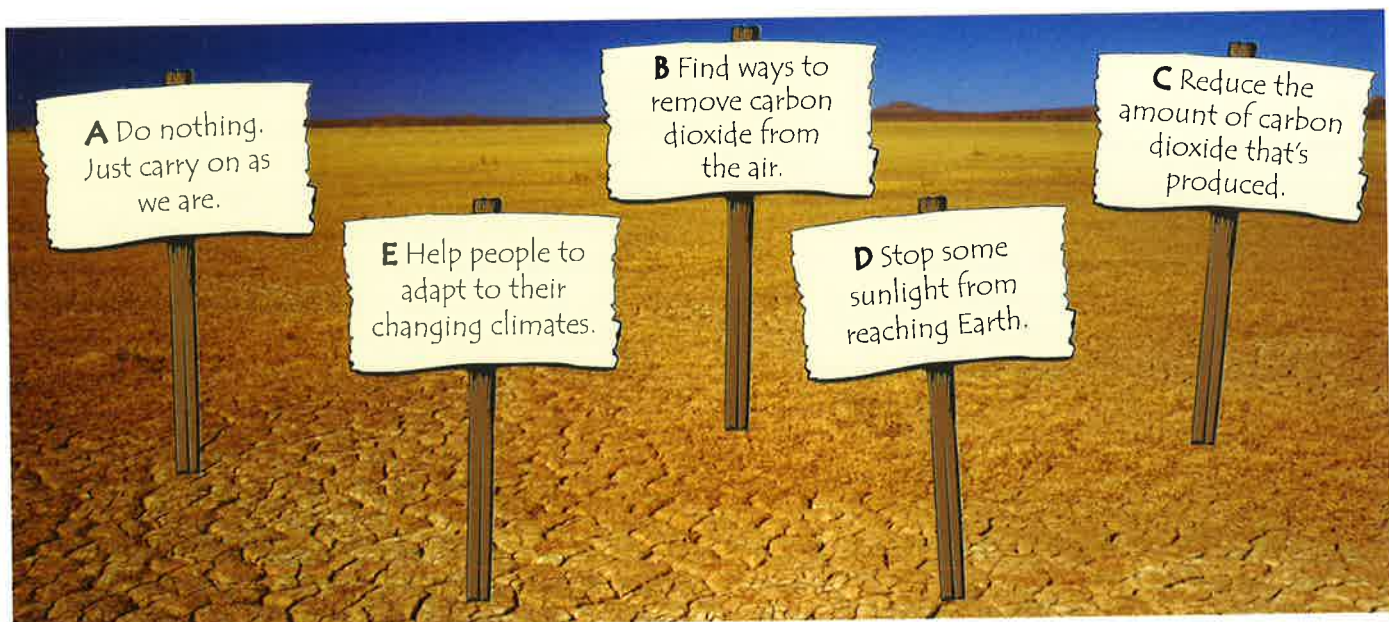
▲ Protestors outside a United Nations meeting about climate change. (Over 180 governments take part in these meetings.)

Are we there yet?

DEPUTY EXECUTIVE SECRETARY

EXECUTIVE

▲ Inside UN meetings, tensions can rise. It's really hard to get governments to agree on action about climate change.

Your turn

1 Look at the graph on page 100. It shows world carbon dioxide emissions from burning fossil fuels.
  a What does *emissions* mean?
  b Is this true or false? Give evidence from the graph to back up your answer.
   i Emissions are rising.
   ii Emissions are rising faster than ever, since 2000.
   iii Over 6 times more carbon dioxide was emitted in 2010 than in 1950, from burning fossil fuels.

2 Look at these facts. Do they help to explain why carbon dioxide emissions are rising? Give reasons.
  a The world's population is increasing fast.
  b Many countries which were once very poor are now developing quite fast.
  c Flights are getting cheaper and cheaper.

3 Think about the five options at the bottom of page 100.
  a Which one do you think is the best for us humans?
  b Which one do you think is the worst for us?
  c **i** Write the options out fully, in your chosen order, from best to worst.
   ii Now give reasons for the order you chose. Like this:

> I put option .... first because ....
> I put option .... second, because ....

4 Most governments are not willing to restrict fuel use in their countries. See if you can come up with an explanation for this.

5 Look at these actions.

> **1** Give free bikes to everyone.
> **2** Breed plants that use more carbon dioxide.
> **3** Don't turn on the heating. Put on warm clothes.
> **4** Put big taxes on air travel.
> **5** Let homes have electricity for only 6 hours a day.
> **6** Breed new crop plants that need less water.
> **7** Turn off all street lights at midnight.
> **8** Find a way to store carbon dioxide underground.
> **9** Make sure all new homes can keep out floods.
> **10** Ban big events like the Olympic Games.
> **11** Put giant mirrors into space, to reflect sunlight away.
> **12** Pay countries to protect their rainforests.

  a Match each action to an option from page 100, using a table like the one on the right.
  b Which actions above depend on:
   i scientists? **ii** the government?
  c Which two do you think would cause most protest from people? Why?
  d Which two would you choose first, if you were in charge? Why?

Option	Action
A	....
B	....
C	1, ...
D	....
E	....

6 Now write a list of things *you* can do, to help reduce carbon dioxide emissions. Your answers for question **1** on page 99 may help.

GLOBAL WARMING WARRIOR

Asia

The big picture

This chapter is about Asia. Here's the big picture …

- Asia is the world's biggest continent, by both area and population.
- It is home to 60% of the world's population (4.3 billion people).
- It sits on the same landmass as Europe – and in fact 5 countries lie partly in Asia, and partly in Europe. (Russia is one of them.)
- It has 49 countries.
- Two – China and India – have 2.7 billion people between them!

Your goals for this chapter

By the end of this chapter you should be able to answer these questions:

- What and where is Asia?
- Which oceans and sea areas border it? Name all the oceans, and at least four other coastal waters (seas, bays, gulfs).
- What are Asia's main physical features, and where? You should be able to name, and point out on a map:
  - the Himalayas, and at least two other mountain ranges, including one which acts as a border with Europe
  - the Plateau of Tibet, and at least one other plateau
  - Asia's tallest mountain, and largest lake
  - at least five major rivers, including Asia's longest river
  - the Gobi desert, and Thar desert
- Name *at least* 12 Asian countries and their capitals.
- Give at least six facts about the human geography of Asia – about people and their lives. For example, how big is the population?
- List Asia's eight biomes, and give at least two facts about each.

And then …

When you finish the chapter, come back here and see if you have met your goals!

Did you know?
- Between them, China and India have over a third of the world's population.

Did you know?
- Asia is separated from North America by only 82 km of water.

Did you know?
- Japan is the only country in the world that still has an Emperor.

Why…
- … does Asia have so many islands?

Why…
- … is there so much ocean?

Your chapter starter

The satellite image on page 102 shows Asia, and parts of other continents.

Some parts of Asia look green, and others are sand-coloured. Why is this?

Look at the thick dark curve in the middle of the image. What do you think that is?

Three oceans are shown here, and a number of seas. See how many you can name.

Which areas on the image belong to other continents? Which continents?

Home again, Mr Polo?

What and where is Asia?

Here you'll compare Asia with other continents.

Asia: a continent

Asia is one of the world's seven continents. Look at map **A**.

A
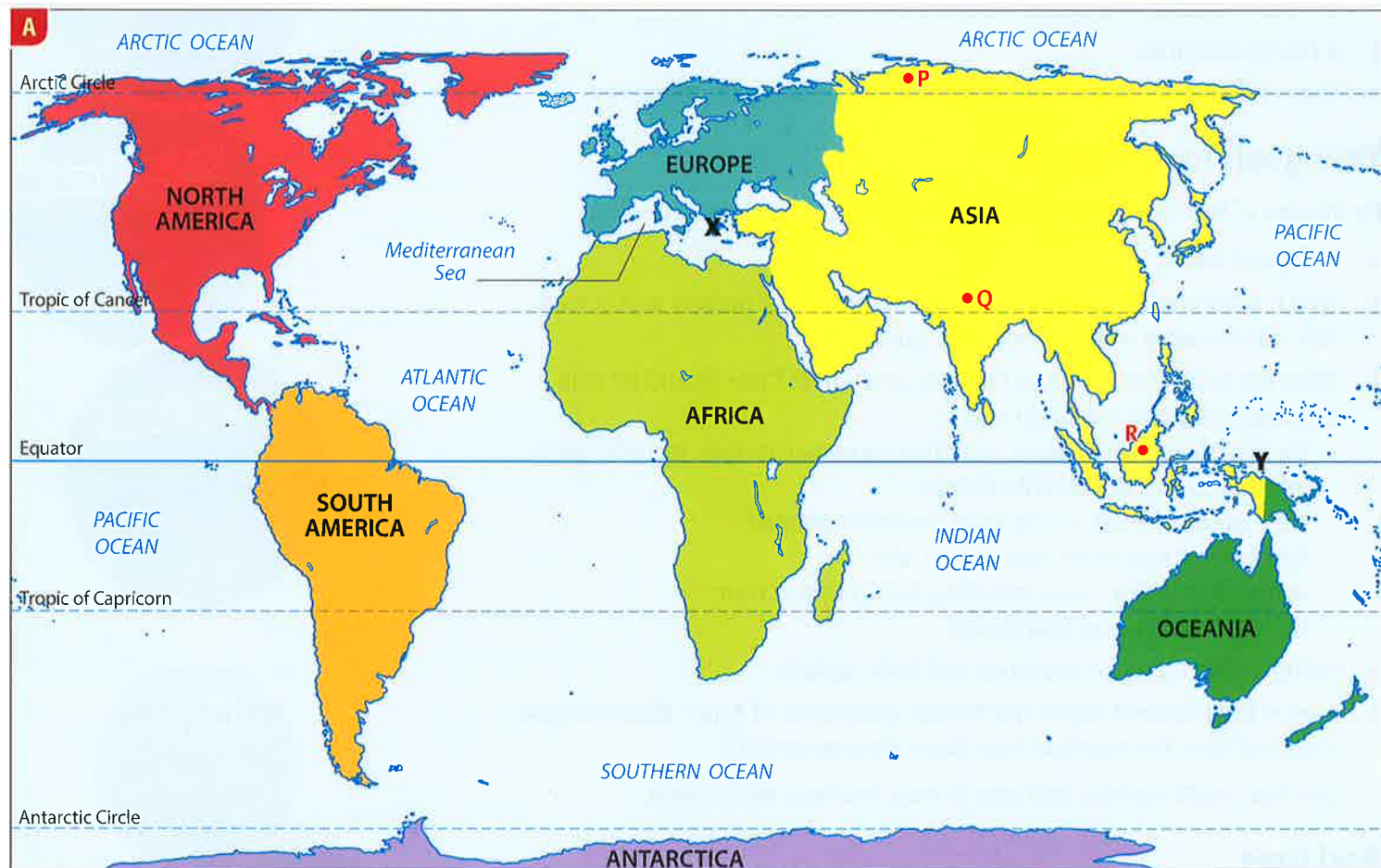
Where are Asia's borders?

With Europe

Asia is joined to Europe. So why do we call it a separate continent? That began with the Ancient Greeks, around 2500 years ago. (Greece is at **X** on the map above.) They didn't know much about the world to the east of Greece. So they called it *Asia*, from a word that means *east*.

Since then, we have argued about its border. Today, most people accept the one shown on map **B**. It cuts through some countries. For example most of Russia lies in Asia – but most of its people live in the European part!

With Oceania

Asia's border with Oceania wiggles *between* islands. But look at the island marked **Y** on map **A**. Half of it is in Asia, and belongs to Indonesia. The other half is in Oceania, and is called Papua New Guinea.

B

The largest continent

Asia is the world's largest continent, for both area and population.
Look at these two tables.

The continents by land area

Continent	millions of square km
Asia	44.6
Africa	30.1
North America	24.5
South America	17.8
Antarctica	13.2
Europe	9.9
Oceania	8.1

The continents by population

Continent	millions of people
Asia	4300 (or 4.3 billion)
Africa	1111 (or 1.1 billion)
Europe	743
North America	565
South America	407
Oceania	38
Antarctica	people only visit

Your turn

1 This graph compares the **areas** of the seven continents.
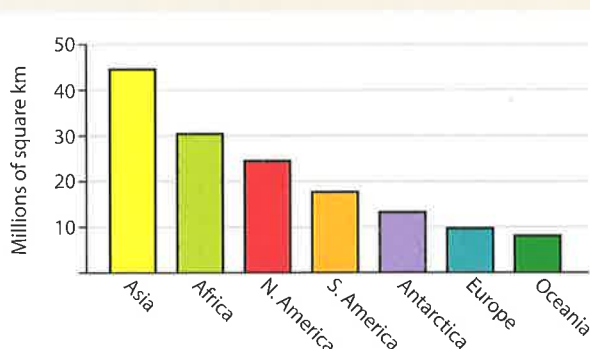
Using the graph, decide whether each statement below is true, or false. If false, rewrite it to make it true.
A Together, Africa and Europe would fit into Asia.
B Together, North and South America would fit into Asia.
C Asia is over five times the size of Europe.

2 This pie chart compares the **populations** of the continents.
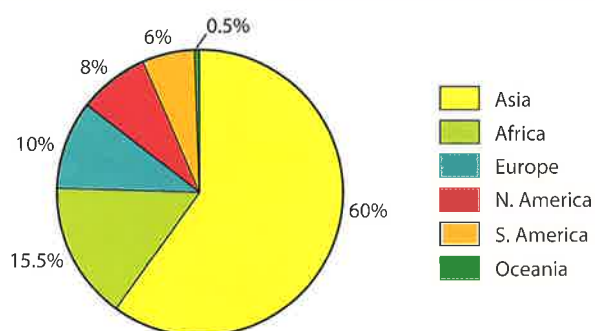
True or false? If false, write a correct statement.
A More than half of the world's population lives in Asia.
B Asia has over five times more people than Europe has.
C There are over ten times more people in Asia than in North America.

3 Now look at the blue lines on map **A**.
   a Does the Equator pass through Asia? Yes or no?
   b Do any other major lines of latitude pass through Asia? If yes, name them.
   c Look at the places **P**, **Q**, and **R** marked on the map.
      i One is very cold, with long dark winters. Which one?
      ii One is hot and wet all year, and still has some tropical rainforest left. Which one?
      Explain your choice each time.

4 Next, look at the oceans on map **A**.
   a Write a paragraph about the oceans which border Asia. You must include their names, and these words:
      coast   north   south   east
   b Imagine you sail east from Asia, across the Pacific Ocean. Where will you end up?

5 Look at the border between Asia and Europe, on map **B**. It makes use of physical features. For example, it follows the Ural Mountains.
   See if you can write a paragraph to describe the border's route, from north to south. Include all these terms:
      Arctic Ocean   Black Sea   Caspian Sea
      Mediterranean Sea   Ural Mountains

6 Asia is a continent.
   a First, explain the difference between a *country* and a *continent*. (Glossary?)
   b Now, a challenge. See how many Asian countries you can list, *without looking at a map*. (There are 49.) Try to come up with at least five. No peeking!

7 It's time to start a spider map for Asia.
   – Use two pages, so that you can make it nice and big.
   – Mark in facts you know already.
   – Try to group them under headings. (For example *Population*, and *Size and location*.)
   You can add to your spider map as you work through this topic. It will become your summary for Asia.

Asia's countries and regions

Asia has 49 countries. Find out more about them here.

The countries and their capitals

Some Asian countries are huge. Some are tiny. This map shows their capitals too.

B Compare!

A

Arctic Circle

ARCTIC OCEAN

KALININGRAD (Russia)

Moscow

R U S S I A

Kuril Islands (Russia)

Ankara
TURKEY
GEORGIA Tbilisi
ARMENIA
Yerevan
Astana
K A Z A K H S T A N
Ulan Bator
MONGOLIA
NORTH KOREA
JAPAN
Tokyo

LEBANON
Beirut
ISRAEL
SYRIA
Damascus
Jerusalem
Baku
AZERBAIJAN
UZBEKISTAN
Tashkent
Bishkek
KYRGYZSTAN
X
Beijing
Pyongyang
Seoul
SOUTH KOREA

IRAQ
Amman
Baghdad
JORDAN
KUWAIT
Tehran
TURKMENISTAN
Ashgabat
Dushanbe
TAJIKISTAN
Kabul
AFGHANISTAN
Islamabad
Jammu & Kashmir

Kuwait
Manama
Riyadh
BAHRAIN
QATAR
Doha
Abu Dhabi
UNITED ARAB EMIRATES
Muscat
I R A N
PAKISTAN
New Delhi
NEPAL
Kathmandu
BHUTAN
Thimphu
C H I N A
Taipei
TAIWAN
Ryukyu Islands (Japan)
Tropic of Cancer

SAUDI ARABIA
Sana
YEMEN REPUBLIC
O M A N
Socotra (Yemen Republic)

I N D I A
Dhaka
BANGLADESH
MYANMAR
Nay Pyi Taw
LAOS
Vientiane
Hanoi
Manila
THE PHILIPPINES

PACIFIC OCEAN

THAILAND
Bangkok
VIETNAM
CAMBODIA
Phnom Penh

Andaman Islands (India)

Lakshadweep (India)

MALDIVES
Malé
Colombo
SRI LANKA
Nicobar Islands (India)

BRUNEI
Bandar Seri Begawan

M A L A Y S I A

Equator

Kuala Lumpur
SINGAPORE
I N D O N E S I A

INDIAN OCEAN

Jakarta
Dili
EAST TIMOR

Key

CHINA country names are shown like this
■ capital cities
——— country boundary
- - - - disputed country boundary
········ continental boundary

Asia's regions

Asia's countries are grouped into regions. This map shows the regions.

Look at West Asia. It is usually called *the Middle East*.

▲ The Heart of Asia *monument marks the centre of Asia – near the town of Urumqi in China. (See* **X** *on the map on page 106.)*

C

NORTH ASIA

CENTRAL ASIA

WEST ASIA (OR THE MIDDLE EAST)

EAST ASIA

SOUTH ASIA

SOUTHEAST ASIA

Arctic Circle

Tropic of Cancer
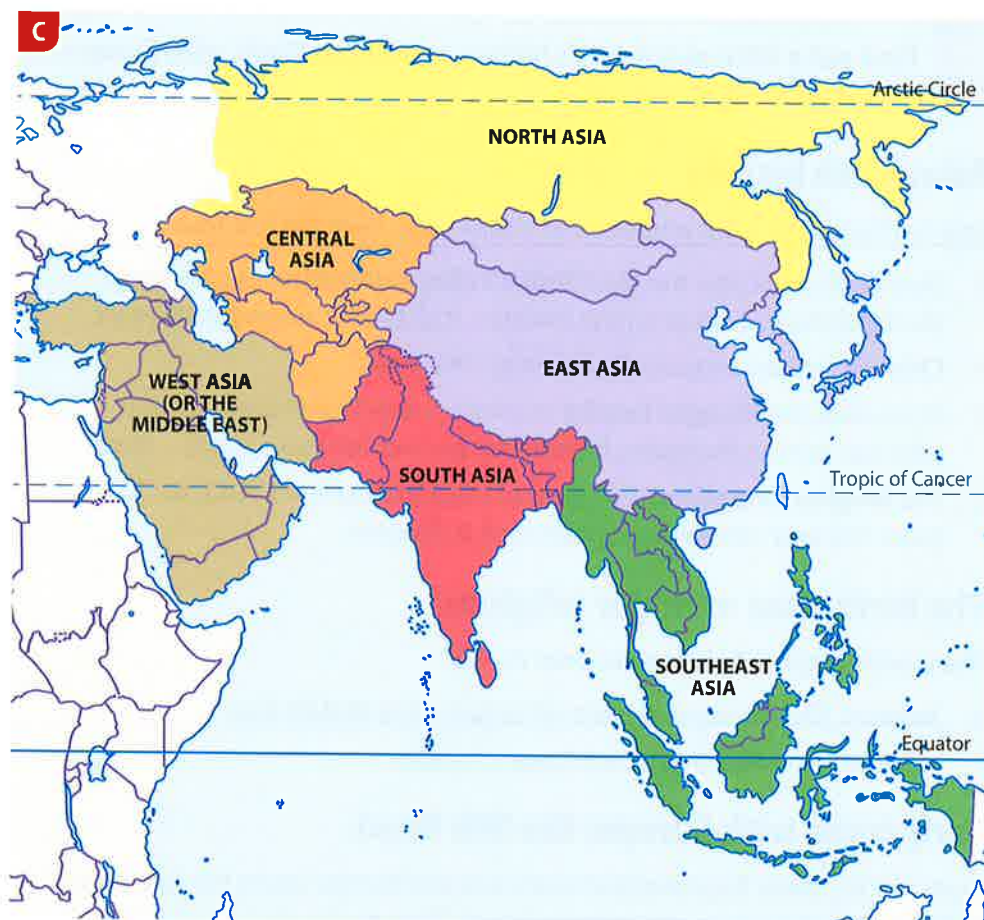
Equator

Your turn

1 Find these countries on map **A**, and name them.
   a It is sandwiched between Russia and China.
   b It lies to the east of China, and its name starts with J.
   c It borders the Arctic Ocean.
   d Sri Lanka lies off its coast.
   e The Equator passes through this country of many islands.
   f It shares borders with China, Laos, and Thailand.
   g This small island country lies near the Equator. Its port is one of the busiest in the world. Its name has 9 letters, and ends in *e*.
   h These two countries, near Japan, were once a single country. You can guess this from their names.
   i Its name has four letters, and ends in *q*.

2 Now see how many countries you can find, beginning with:
   a M   **b** P   **c** I   **e** T

3 Find each capital city below on map **A**. Then write down the capital, and its country.
   a Riyadh   **b** Jakarta   **c** New Delhi
   d Kabul   **e** Hanoi   **f** Beijing
   g Pyongyang   **h** Kuala Lumpur **i** Moscow
   j Manila   **k** Islamabad   **l** Ulan Bator

4 Of Asia's 49 countries, 27 are smaller than the UK in area. Map **B** shows the UK at the same scale as map **A**.
   a Pick out four Asian countries that are bigger than the UK.
   b Now pick out four you think are smaller than the UK.

5 Map **C** shows the main regions of Asia.
   See if you can name countries in each region, as follows:
   a five in Central Asia, all with names ending in - *stan*.
   b four in South Asia
   c the only country in North Asia
   d five in West Asia (the Middle East)
   e five in East Asia
   f five in Southeast Asia

6 The *Middle East* was given that name by Europeans. Which name do you think suits it better: *the Middle East* or *West Asia*? Give your reasons.

7 The border between Asia and Europe is shown on map **A**. Name two countries it passes through.

8 a In which Asian country would you find polar bears?
   b Name all the Asian countries that lie completely within the tropics.

A little history

Find out a little about Asia's history and its past links with Europe … including Britain.

Asia: a rich history

Asia has had many great empires and civilisations. Here are just four.

- Over 5000 years ago, the great **Indus Valley civilisation** began along the Indus River, in what is now Pakistan. It lasted for around 2000 years.
- **Chinese** civilisation goes back almost 5000 years.
- At its peak, the **Mongol Empire** was vast. It was founded by Genghis Khan who was born in Mongolia. It lasted for around 160 years (1206 – 1368).
- The **Mughal Emperors** ruled most of India from around 1555, for 300 years. The end came when Britain took India over.

The birthplace of major religions

The world's major religions were born in Asia.

- Judaism, Christianity and Islam all began in the Middle East.
- Hinduism and Buddhism both began in India.

Early trade with Europe: the Silk Road

From 100 BC, trade flourished between Asia and Europe along the **Silk Road**. This network of trade routes stretched from China to the Mediterranean. Some routes crossed deserts. Some were by sea.

It was called the Silk Road because Chinese silk was the main thing traded. But porcelain, spices, dates, tea, jewels, and perfumes were all traded too. Europeans were hungry for exotic things from China and India. (China and India were wealthier than European countries then.)

But the Silk Road trade ended around 1453, because rulers in Turkey banned trade with the west. They were angry about the Crusades.

Did you know?
- Marco Polo, an Italian merchant, set off for Asia in 1271 – and got home 24 years later.
- He wrote a famous book about his travels.

▲ Genghis Khan, on a modern Mongolian bank note. Khan means Emperor.

▼ The Mongol Empire at its peak, and the Silk Road, which the Mongols protected.

A

Mongol Empire
Silk Road network

▼ Take care with my Chinese porcelain! The things they are carrying may find their way to Europe, along the Silk Road.
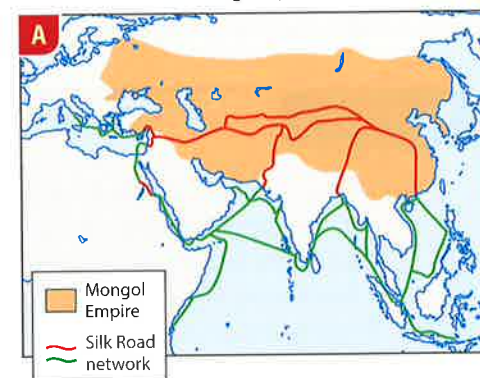
▼ Silk is made from fibre spun by silkworms. China tried hard to keep this secret. But eventually silkworms were smuggled out.

Europeans arrive by sea

After the Silk Road trade ended, Europeans looked for sea routes to Asia.

First came the Portuguese, who landed in India in 1497. Later the Dutch, Spanish, French, Germans, and British arrived – and the USA too.

They came to buy silk, and porcelain, and spices, and tea. When the Industrial Revolution got under way in Europe, they bought cotton and other raw materials. And they sold goods from their factories.

Battles over trade

The Europeans fought each other over trade with Asia. The Dutch drove the Portuguese out of many places. The British did the same to the French.

Meanwhile, China was hostile to them all, and tried to restrict trade. Britain fought two wars with China, to force it to let British traders in.

From trade to colonisation

After a time, the foreigners took control of several Asian countries, and turned them into **colonies**. Map **B** shows the colonies they held in 1910.

China was not colonised. But it was weakened by years of conflict. Two of its trading posts were in foreign hands: Hong Kong (British), and Macau (Portuguese).

Independence

In the end, the colonies won their freedom. India gained independence from Britain in 1947 – and at the same time Pakistan split from India, to form a separate country. (Bangladesh split from Pakistan later.)

Hong Kong was finally handed back to China in 1997. Macau was handed back in 1999.

Today

Today, trade between Asia and the rest of the world is flourishing. China is the world's top exporter of goods. Our new Silk Road is made up of container ships, oil tankers, gas pipelines, and the internet. Find out more in the next unit.

Did you know?

- In 1492, Christopher Columbus sailed west from Spain, looking for Asia.
- He landed in the Caribbean and thought it was part of Asia … so he named it the West Indies.

Key
- British
- Dutch
- French
- German
- American

Equator
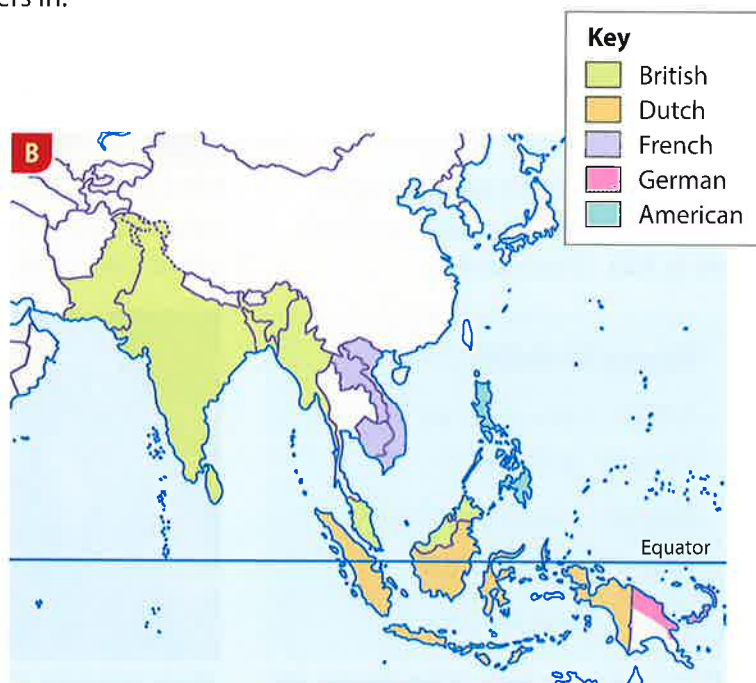
▲ Colonies in Asia in 1910.

Your turn

1 a Who was Genghis Khan?
  b Name three Asian countries which were once part of the Mongol Empire. (Map **A** and page 106 will help.)

2 a What problems might traders have met with, on the Silk Road? See how many you can think up.
  b The Silk Road was important to rich Europeans. Why?

3 China didn't want other countries to make silk. Why not?

4 Map **B** shows colonies in Asia in 1910.
  a What is a *colony*?
  b Name three countries which were colonised by Britain.
  c Name three which were colonised by France.
  d Which country was an American colony?

What's Asia like?

This unit will give you an overview of Asia today.

The most diverse continent of all

Asia is the biggest continent. It has more people, and more cultures, and a bigger range of climates and environments, than any other continent.

Asia's people

40% 60%

■ Asia
■ Rest of the world
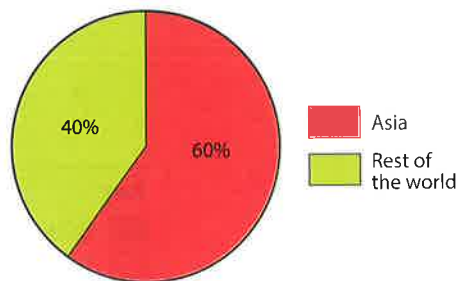
Asia has around 4.3 billion people. 60 out of every 100 people on Earth are in Asia. (That's 60%.)

More than half (2.7 billion) are in just two countries, China and India – the world's two most populous countries.

Across Asia there are thousands of different ethnic groups. India alone has more than two thousand.

Happy birthday ... in

Arabic	عيد ميلاد سعيد
Chinese	生日快乐
Russian	С днём рождения
Thai	สุขสันต์วันเกิด
Urdu	سالگرہ مبارک ہو

There are thousands of languages too. (Some are not very widely used.) Here's *Happy birthday* in a few.

Many religions are practised in Asia. The top three, biggest first, are Islam, Hinduism, and Buddhism.

About 58% of the population lives in rural areas – mostly as farmers. (The figure for Africa is over 60%.)

But Asia has enormous cities too. 7 of the world's 10 largest cities are Asian. This is Shanghai, in China.

About half of Asia's population lives in poverty. As in Africa, poverty is greatest in rural areas.

But you'll find enormous wealth too. The number of super-rich people in Asia is growing fast.

Asia's economy

How are Asia's regions doing? Follow the numbers to find out …

6 Central Asia
Overall, these countries are not rich. But they have oil and gold and other minerals, and are starting to exploit them.

1 North Asia
Russia is doing fine. It sells oil and gas to other countries. It exports them by pipeline.

5 The Middle East
It has a big share of the world's oil and gas reserves. This has made some countries very wealthy. Qatar, for example.

2 East Asia
The main industrial region. You're sure to own things made here – in China, or Japan, or South Korea, or Taiwan.

4 South Asia
Asia's poorest region. Exports include textiles and foodstuffs. India has most of the industry, and runs IT services, and call centres, for other countries.

3 Southeast Asia
These countries depend mainly on agriculture. They export rice and other foodstuffs, and rubber. But industries are developing too.

Even within a region, a country can be much richer or poorer than the country next door. And even if people in a country are well off *on average*, some are always a lot richer or poorer than others.

Your turn

1 Which are the two most populous countries in Asia?

2 Pick out what you think are the three most interesting facts about Asia from page 110.

3 Look at the map above. Which of Asia's regions:
   a is the main industrial region?
   b has a large share of the world's oil deposits?
   c is poorest, overall?

4 *GDP per person (PPP)* is a way to measure the economy. It gives you an idea of how well off people are, on average. This question is about the table on the right.
   a What does *GDP per person (PPP)* mean? (Glossary.)
   b i For which country in the table is it highest?
     ii Why is that country so well off? (Look above.)
     iii About how many times better off are people there, on average, than people in the UK?

5 From the table, pick another country *in the same region as* the country in **4**, where people are much poorer. (Page 106?)

Country	GDP per person (PPP) in dollars
Afghanistan	1200
Bangladesh	2100
China	9800
India	4100
Indonesia	5214
Japan	37 000
Qatar	98 800
Russia	17 900
Yemen	2300
UK	37 500

6 Which country in the table is most like the UK, for GDP per capita (PPP)?

7 *Asia is a continent of great contrasts.*
   Write a paragraph of 70 words on this topic, using what you learned in this unit.

Asia's physical features

Here you can learn about Asia's key physical features – and which countries they lie in.

Mountains, rivers, deserts, glaciers ...

Asia has a huge range of amazing physical features, from cold windy plains to scorching hot deserts, glaciers, and the world's highest mountain range.

This map shows the main ones. 'Your turn' has questions about them. Get ready to become a map detective!

Did you know?
♦ The Himalayas are growing taller by about 6 cm a year.

Key

land height above sea level, in metres

- more than 3000 m
- 2000 – 3000 m
- 1000 – 2000 m
- 500 – 1000 m
- 200 – 500 m
- less than 200 m
- below sea level
- ▲ highest peaks (m)
- ⋯⋯ border between continents

Your turn

The map on page 106 will also help you answer these questions.

1 Find the Plateau of Tibet, on the map opposite.
It is over 4.5 km high, on average. It is sometimes called 'the roof of the world'. Here's one view of it:

  a What is a *plateau*? (Glossary?)
  b Most of the Plateau of Tibet lies in one country. Which one?

2 Asia has other big plateaus too – but not so high.
Name the plateau that lies in:
  a southern India   b Turkey   c Russia

3 Several of Asia's big rivers rise in the Plateau of Tibet.
  a List them, and for each, name the sea or bay it flows into.
  b Now choose the one that matches this description:
   i   It's the third longest river in the world – and it flows through only one country.
   ii   To Hindus, it's a sacred river. It has many mouths.
   iii Many people in Pakistan depend on this river, for water.
   iv   This river flows through six countries. One is Cambodia.

4 Asia has the world's highest mountain range. Here's a photo:

  a This mountain range is called …?
  b Which countries share it?
  c Its highest peak is the world's tallest mountain, called …?
  d It also has another tall peak, in Pakistan, on which many climbers have died. Name that one too.
  e The landform just north of this mountain range is …?

5 a Asia has other mountain ranges too. See if you can name:
   i two that are fully in China   ii two that lie in Iran
  b The Altai Mountains are shared by four countries.
     These countries are …?

6 Now for some more about water.
  a Name the large inland sea in Asia.
  b Which countries border this sea?
  c The map shows the largest river that feeds it.
     The river is called the …?

7 a Which oceans border Asia?
  b What's the difference between an ocean and a sea?
  c Name the sea that lies:
   i   off the north east coast of Russia
   ii   between Vietnam and the Philippines
   iii off the south coast of Pakistan

8 Now look at the Bay of Bengal.
  a Name three countries which border it.
  b What is the difference between a bay and a sea?

9 a What is a *peninsula*?
  b Asia's biggest peninsula is shaped like a wellington.
     It is mostly hot desert. Name it, and three countries in it.
  c Which peninsula on the map has Malaysia at its tip?

10 The Gobi desert is a large cold desert, about 5.5 times the size of Great Britain. It gets bitterly cold in winter.
  a Why is it cold, not hot?   b Which countries share it?

11 Look at the satellite image below.
  a **X** marks a hot desert shared by India and Pakistan.
     What is its name?
  b Name the river shown as a blue line.
  c Name the mountain range marked **Y**.

Asia's population

Some parts of Asia are crowded, and some are almost empty. Here you can find out more, by exploring a map.

Where is everyone?

Asia is the most populous continent. It has about 4.3 billion people!

The map below shows the **population density**. The deeper the shade, the more people live in that area. And note the symbols for cities too.

Key

Population density
people per square kilometre

■ (dark red)	over 100
■ (orange)	10–100
■ (tan)	1–10
□ (cream)	under 1

Major cities
population in millions

□	over 3
■	1–3
●	0.5–1
·	0.1–0.5

▲ *Where is everyone?*

▲ *Singapore. What can you say about its population density?*

Your turn

1 What does *population density* mean?

2 From the map, decide whether each statement is true, or false. If false, rewrite it to make it true.
  a Around half of Asia is only lightly populated.
  b Most people live in the northern half of Asia.
  c Overall, Russia is more densely populated than China.
  d Overall, the Asian part of Russia is more densely populated than the European part.
  e Many of India's big cities (with at least one million people) lie in a strip along its northern border.
  f Most of China's cities are in central China.

3 Find the four places marked **W**, **X**, **Y** and **Z** on the map.
  a Are there fewer people around **W**, or around **X**? See if you can suggest a reason.
  b What's the population density at **Y**?
  c What's the population density at **Z**? Suggest a reason.
  d Now match each place **W** – **Z** to a country. (Page 106.)

4 Look at the bar graph on the right. It shows the ten most populous Asian countries, and the UK for comparison. (Russia isn't in, since most of its people live in Europe.)
  a Which two countries have most people, by far?
  b Which has a bigger population, China or India?
  c About how big is the population of China? Give your answer in: **i** millions **ii** billions
  d Which of the countries have under 100 million people?

5 Look at the bar graph. How many more people are there …
  a in China than in the UK?
    i about 52 times more **ii** about 21 times more
  b in India than in Pakistan?
    i about 7 times more **ii** about 17 times more

6 Photo **B** shows Singapore, one of Asia's smallest countries. It is very wealthy. It is heavily built up. It has an area of about 700 square km. (So it's about six times the size of Manchester.) It has a population of about 5 400 000.
  a Work out the population density of Singapore. Give your answer as a whole number, and give the correct units.
  b What problems might this population density cause? See how many you can think of.

7 Think again about China's population.
  a In what ways might such a big population be a problem for China? See how many ways you can think of.
  b In what ways might it benefit China?

The ten most populous Asian countries (and the UK for comparison)

Population (millions)
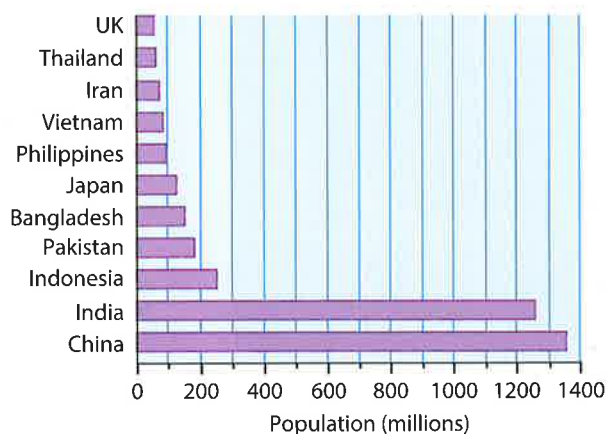
Asia's biomes

Because of its size, Asia has a wide range of biomes. Find out more here.

Asia's biomes

A **biome** is a large region with its own distinct climate, plants, and animals. The climate dictates what the biome is like.

Asia stretches from above the Arctic Circle to below the Equator. It has mountain ranges too. So that means it has many different climate zones – and biomes. Look at these photos. The colours of the circles match the map on the next page.

Did you know?
- They say the Abominable Snowman (or Yeti) lives around the Himalayas.
- Tall, hairy, walks on two legs, big feet.

In the far north is the **tundra** biome. It is bitterly cold here, and the ground is deeply frozen. But in summer, the surface thaws. Then ponds form everywhere, and low plants grow.

South of the tundra is the **taiga** biome. It has thick **coniferous** forests with trees such as spruce and fir. Winters are long, and very cold. Summers are short, warm, and damp.

Next, in the middle of the continent, are the **steppes**: plains of grassland. Summers are hot, winters very cold. There are few trees, because there is not enough rain to support them.

Between the steppes and the coast it is much wetter. This is the **temperate forest** biome, with **deciduous** trees. Summers are hot here. Winters are cold, and very cold in some places.

But south of the steppes it is very dry. You are in the **cold desert** biome! Summers are hot, but cloudless skies mean cold nights. Winters are brutally cold (– 40 °C or less).
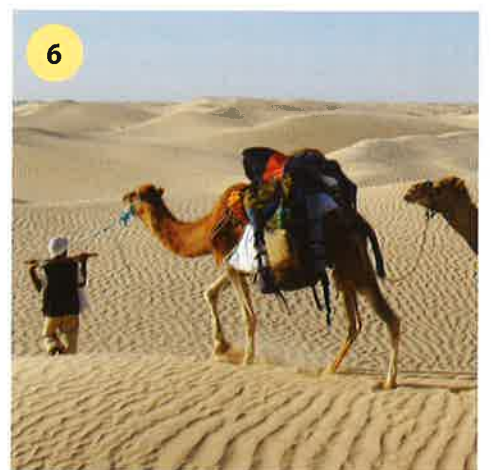
Further south you'll find more desert. But now it is **hot desert**. It is usually very hot during the day, and cold at night. As in the cold desert, vegetation is sparse since there's so little rain.

Mountain ranges have the **mountain** biome. The higher you go, the colder it is. After a certain point it's too cold and dry for trees. Go high enough and you will find glaciers.
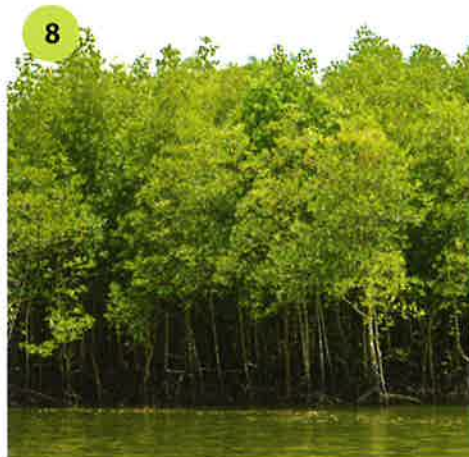
Furthest south, in and near the tropics, is the **warm moist forest** biome. The forests include **tropical rainforests**, and **mangrove swamps** like this one. (See the map key.)

Did you know?
- Much of Indonesia's rainforest is being cleared to grow oil palm trees.
- Palm oil is used in bread, biscuits, ice cream, shampoo . . .

Key
- tundra
- taiga
- steppe
- temperate forest
- cold desert
- hot desert
- mountain
- warm moist forest
- mangrove swamp

Asia's biomes on the map

This simplified map shows the main biomes. The colours match the circles in the photos.

As you saw earlier, much of Asia is densely populated – and this has affected the biomes.

For example, 8000 years ago, nearly all of Southeast Asia was covered by forest. Now half has gone – cut down for fuel, or cleared away for farmland, and roads, and settlements.

Asia's tropical rainforests are Earth's oldest, and the richest for biodiversity. But they are vanishing very fast.

Arctic Circle

X

Tropic of Cancer

Equator
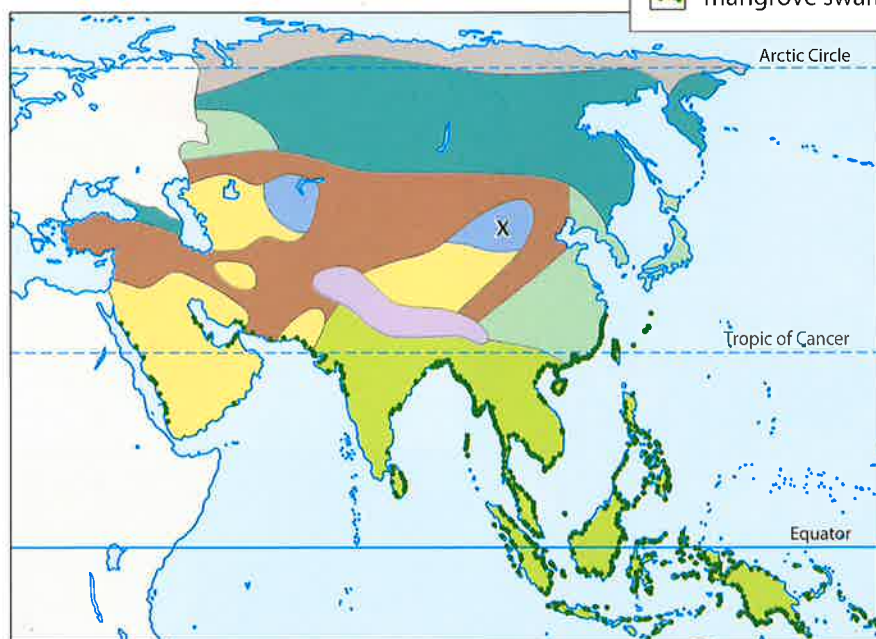
Your turn

1 What is a *biome*?

2 Asia has a wide range of biomes. Why?

3 Name the biome in Asia:
 a which lies furthest north
 b where you are most likely to find large flocks of sheep

4 Write down what each word means. (Glossary?) Then name the biome it is linked to.
 a temperate b tree line c coniferous
 d mangroves e permafrost f deciduous

5 Using the map above and the one on page 106, name:
 a a country with tundra
 b a country where you'll find dense coniferous forests
 c three countries with hot deserts
 d two countries with cold deserts
 e two countries where you may find rainforest
 f three countries with mangrove swamps along the coast

6 Now look at **X** on the map above. The population density here is low. (See page 114.) Explain why.

CHINA

Beijing

The big picture

This chapter is about the Southwest region of China. Here's the big picture …

- Southwest China is one of China's six regions.
- It is over ten times the size of the UK, with over three times as many people.
- Much of it is mountainous, and several great rivers flow through it.
- It is not a wealthy region. But the government is working to develop it.
  So it is changing fast.
- It is one of the world's most biodiverse regions.
- Southwest China has many dams – and many more are planned.

Your goals for this chapter

By the end of this chapter, you should be able to answer these questions:

- Since 1979, China has lifted hundreds of millions of people out of poverty.
  How did it do this?
- China's rapid growth has led to some problems. Give two examples.
- The government wants to develop the west of China quickly. Why?
- The Southwest region is divided into smaller areas. What are their names?
- Give at least eight facts about Chongqing: about its location, economy,
  and how it is changing.
- Why are pandas under threat, and what is being done to help them?
- Give at least ten facts about Tibet: about its location, and climate, and
  people, and how it is changing.
- Southwest China is an important region for dam-building. Why?
- Give some benefits and drawbacks of dam building in Southwest China.
  (At least two of each.)

And then …

When you finish the chapter come back here, and see if you've met your goals!

Did you know?
- The most common surname in China is 'Wang'. (It means 'king'.)
- Over 93 million people have it.

Did you know?
- In China, surnames are written first.
- A woman does not take her husband's surname.

Did you know?
- China and India are in dispute over territory.
- Both claim the land shown in grey on the little map on page 118.

What if...
- … you learned Chinese?

Why...
- … is China's flag mostly red?

Why...
- … is china named after China?

Your chapter starter

The photos on page 118 were all taken in Southwest China.

Which continent is China in?

What can you say about Southwest China, just from these photos?

What contrasts can you see, in the photos?

Which photo(s), if any, might be connected to you? Explain.

So you are going west?

China: an overview

This unit and the next will give you a broad look at China. Later, you will focus on just one region.

A big important country

China is one of the world's most important countries.

- It has the most people: over 1.37 billion. Roughly one in every five people in the world is Chinese!
- It is the fourth biggest country by area. (After Russia, Canada, and the USA.)
- 500 years ago, it was one of the world's wealthiest countries. It fell behind, but now it is catching up fast.
- Today it is the world's top exporter of goods. You are sure to own things made by people in China. Clothing, shoes, toothbrush, mobile, computer …

China is rising. You will hear a lot about it in the years ahead.

China's physical features

About two-thirds of China is mountainous, or hilly. Look at map **A**.

▲ Made in China.
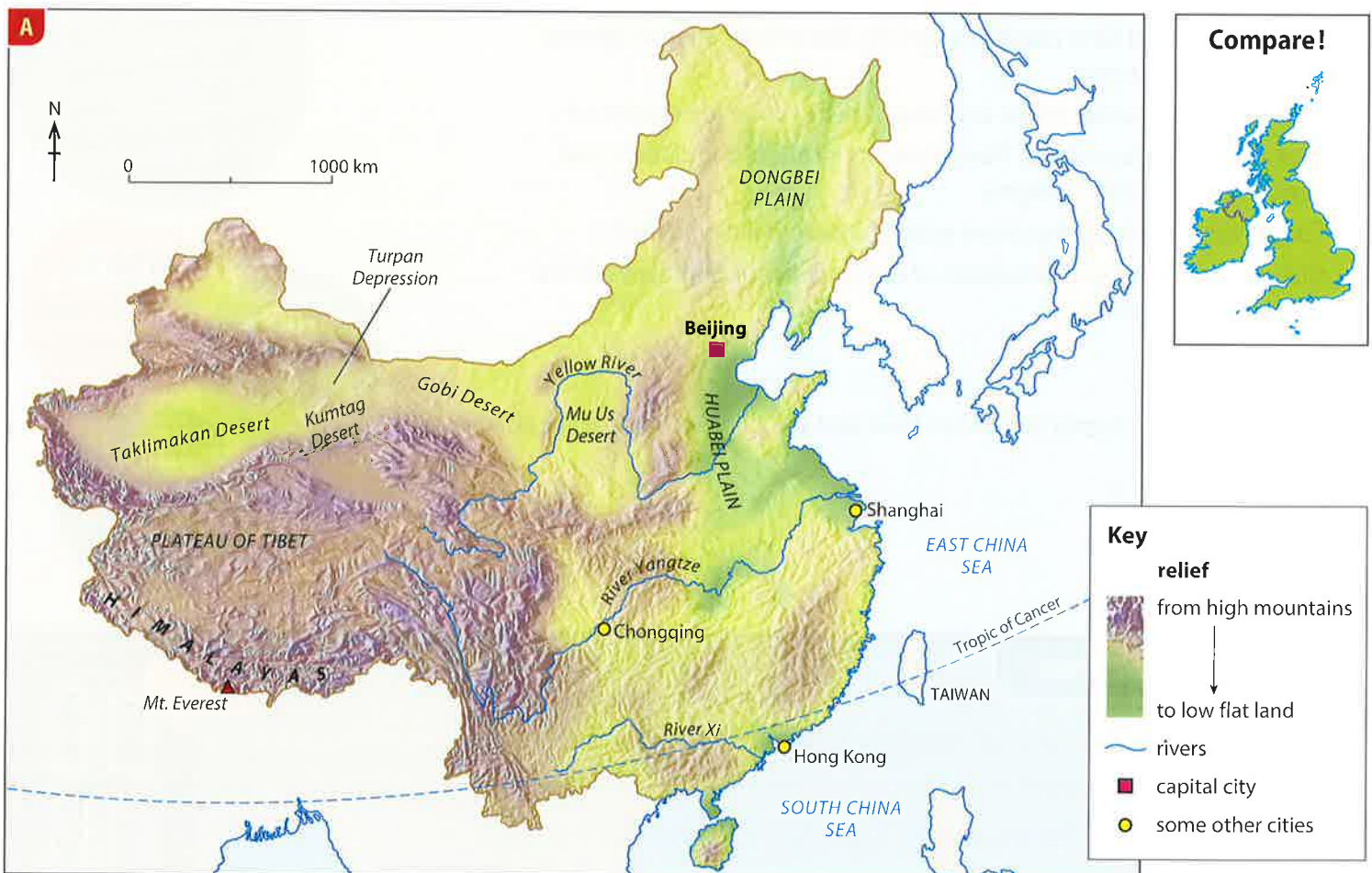
China has thousands of rivers. The map shows only a few. Look at the Yangtze. It is the third longest river in the world, after the Nile and the Amazon.

Climate

Because it's so big and so mountainous, China has a wide range of climates.

♦ The far south is in the tropics. The far north is much cooler.

♦ The higher you go in the mountainous areas, the colder it gets.

♦ In summer, the land heats up fast. It heats the air, which rises fast. So moist **monsoon winds** are drawn in from the south east, from over the sea. They bring the **monsoon rains**.

♦ Inland, away from the sea, you find big temperature differences between summer and winter.

♦ Look at the very dry area on map **B**. This is where China's deserts are. They are **cold deserts**. They may get warm or hot in summer, but are very cold in winter, and at night.

B **China's climate zones**

cold, quite wet

dry

very dry

cold (very high) and dry

mild and wet

Tropic of Cancer

tropical (hot and wet)
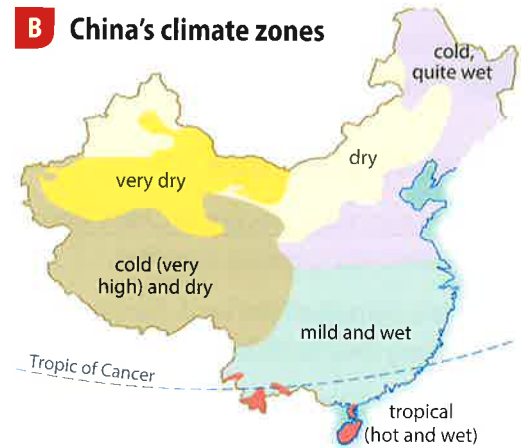
So where is everyone?

Where does everyone live, in this mountainous country?

Map **C** shows how population changes across China's six big regions.

Look at the contrasts. Two regions are heavily populated. But the two biggest regions, in the west, have large areas that are sparsely populated.

The Southwest region

Look at the Southwest region in **C**. This is the region we'll focus on later in the chapter. Get ready!

C **Population distribution in China**

NORTHEAST

NORTHWEST

NORTH

Z

Beijing

X

Y

Shanghai

Chongqing

EAST

SOUTHWEST

Hong Kong

SOUTH CENTRAL

Key

people per sq km

- over 100
- 10–100
- 1–10
- under 1

cities

- capital city
- some other cities
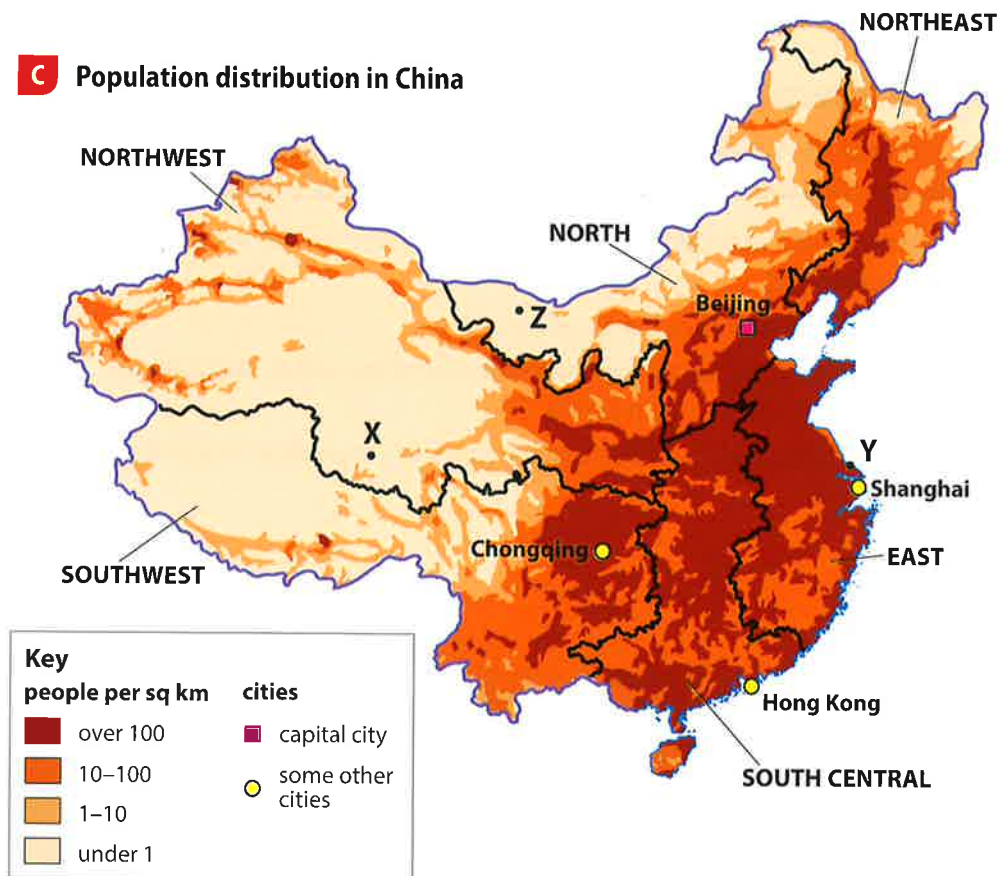
Your turn

1 Look at China in map **A**.
   a About how wide is it, at its widest?
   b What is the maximum distance from north to south?

2 Describe the pattern of *relief* in China, in 25 words.

3 Using maps **A**, **B** and **C**, say as much as you can about:
   a Beijing   b the Gobi desert

4 Describe the pattern of *population distribution* in China.

5 Look at places X, Y, and Z on map **C**. For each place:
   a give its population density
   b try to give reasons to explain its population density

6 What are *monsoon rains*? (Glossary?)

7 See if you can explain why the monsoon rains do not reach the Taklimakan desert.

8 Now list the countries that border China. Page 106 may help.

The rise of China

China has undergone huge changes over the last 40 years – and it is still changing fast today.

CHINA

China 40 years ago

40 years ago, most people in China were living in poverty, and the population was growing very fast.

The state owned all the land. Farmers were told what to grow. And everything they grew belonged to the state.

The state also controlled the factories and other businesses. People were told what work to do. (In return they had free food, and education, and health care, and support when they grew old.)

China had also turned its back on most other countries.

A new direction

In 1979, with the country in poor shape, China's leaders decided that a new direction was needed. So they set out reforms. For example …

- Farmers could now farm land for themselves, and sell the extra food they produced.
- People could start their own businesses.
- China would open up to trade with the rest of the world, and foreign companies could set up in China.
- The **one-child policy** was also put in place (no more than one child per family).

▲ China is ruled by the Communist Party. Its first leader was Mao Zedong. (Mao is his surname.) He died in 1976.

Did you know?

- China insists that it owns the island of Taiwan.
  - The people of Taiwan say no.

民族要振兴 人口要控制

▲ A poster for the one-child policy. If you had more than one child you could be fined, or punished in some other way.

▲ The Politburo is the committee which governs China. On the wall is the symbol of the Communist Party: a hammer and sickle.

Success!

The reforms have been a big success. Look:

- In 1981, 85% of Chinese lived in poverty. Today the figure is about 7%.
- China is now the world's top exporter of manufactured goods.
- China now has the second largest economy in the world, after the USA. (But the average wealth per person is still much less than in the USA.)
- The one-child policy has prevented around 400 million births.

Rapid urbanisation

China's success is due mainly to its new factories, making goods for export. Most are in cities and towns in the east, along and near the coast.

Millions of people have moved from rural areas to work in the factories. The rate of urbanisation in China is the fastest the world has ever seen.

The challenges

Success has also brought some big challenges for China. Like these ...

- **Inequality between east and west**. The east of China is wealthier. That's mainly because most of the factories are in the coastal areas.
- **Inequality between urban and rural areas**. The people in the rural areas are the poorest. Some live in extreme poverty.
- **Pollution**. Factories and power stations did little to control pollution. Now pollution of the air and water and soil is a very serious problem.

What's the plan?

China's government is working hard on the challenges. For example ...

- It is pushing development in the west of China. The strategy is 'Go west!'
- It is encouraging more factories to set up, so that more people will move to urban areas, and have a better life.
- It is clamping down on pollution – but knows that clearing it up could take 20 years or more. It aims to lead the world in producing clean energy.

Did you know?
- The one-child policy has now been relaxed.
- If either parent was an only child, the family can have two children.

A

GDP per person (yuan) 2012
- 80 000–100 000
- 60 000–80 000
- 40 000–60 000
- 20 000–40 000
- 0–20 000

▲ *The east is better off than the west.*

▲ *Pollution in the city of Harbin. Over 350 000 deaths in China each year are linked to air pollution.*

Your turn

1 China's full name is *The People's Republic of China*. Why is it called a Republic? (Glossary?)
2 Who was Mao Zedong?
3 Before 1979, China's population was growing very fast.
   a China thought this was a bad thing. Why?
   b What did it do, to tackle the problem?
4 Give 3 ways in which China is different now than in 1978.

5 Much of China's success is due to its exports. Map **A** shows GDP per person.
   a Explain these terms: **i** exports **ii** GDP per person
   b Describe the pattern of wealth in China, from map **A**.
   c See if you can explain why most factories are in the east.
6 China is spending billions to develop the west of the country, and tackle pollution. Where does it get all the money?

China's Southwest region

China is huge. You can't study all of it! So from here on we focus on one region, the Southwest. This unit introduces it.
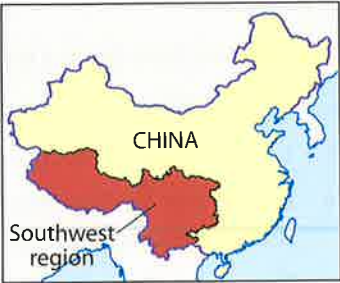
Meet Southwest China

Map **A** shows the Southwest region of China.

It is almost ten times the size of the UK, with just over three times more people.

It is divided into smaller areas.

B gives data for these areas, with the UK for comparison. And the coloured panels tell you more about them.

A

CHINA

Southwest region

SICHUAN

CHONGQING

River Yangtze

TIBET

GUIZHOU

YUNNAN

B	Population (millions)	Population density (people per km²)	% of population that is urban	GDP per person PPP (dollars)
Tibet	3	2.2	15	6138
Sichuan	81	170	33	7642
Chongqing	30	350	49	10 077
Guizhou	35	200	35	3100
Yunnan	46	120	33	4160
UK	64	263	80	37 000

Tibet

(Say *Tib-ette.*) It sits on the Plateau of Tibet. It's cold up there! Tibet has only a small population: 3 million. Most of China's main rivers rise in or flow through it.

Sichuan

(Say *Sich-wa-n.*) Partly mountainous, and partly fertile valley, it's important for farming – and wine. It is rich in metal ores. It has quite a lot of factories, many hi-tech.

Yunnan

(Say *You-nan*.) Tobacco and rubber are grown here, and metal ores are mined. The warm climate and **karst** scenery attract tourists. There are many ethnic groups.

Guizhou

(Say *Gwey-jo*.) Tobacco, forestry, tourism, and coal mining are its main earners. Guizhou also has karst. About 40% of the people here are ethnic minorities.

Why it's a good region to study

You can learn a lot about China from the Southwest region.

- ◆ It is not a wealthy region. People in East China are almost twice as well off, on average.
- ◆ But its development is a priority for the government. So it is changing fast.
- ◆ It has many exciting physical features – including karst landscapes, glaciers, rainforest, and Mount Everest!
- ◆ Most of China's and Asia's main rivers flow through it, as you will see in Unit 8.9.
- ◆ It is one of the most biodiverse regions in the world.
- ◆ It also has many ethnic groups. (China has 56 ethnic groups. But most Chinese – 92% of the population – are Han.)

Chongqing

(Say *Chong-Ching*.) It is based around Chongqing city, an inland port on the Yangtze. The government wants it to be a big centre of industry. It is growing very fast.

Your turn

1 Write down the names of the five areas that make up China's Southwest region. Then say the names to your neighbour!

2 Which area of Southwest China is the most mountainous?

3 Look at table **B**. Which area of Southwest China:
   a has fewest people? b has most people?
   c is more crowded than the UK, on average?

4 a In which area of Southwest China are people, on average …
   i most well off? ii least well off?
   b How wealthy are people in i compared to people in the UK?

5 The region has some amazing karst landscapes. What is *karst*?

6 Now start a BIG spider diagram to summarise what you know about Southwest China. You will add lots to it in later units.

Here you can learn about Chongqing, which has the fastest growing urban area on the planet.

CHINA
Chongqing

Go west!

As you saw in Unit 8.2, China's government aims to:

♦ develop the west of China, which lags well behind the east.

♦ increase urbanisation, to give people a better life.

It chose Chongqing as a special place to help it meet those aims.
So Chongqing is controlled from Beijing (China's capital).
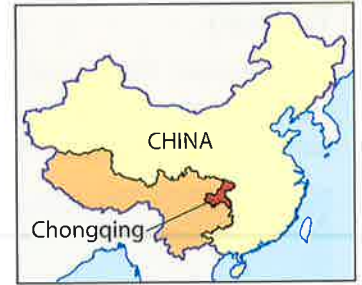
About Chongqing

♦ Chongqing is a little bigger than Scotland.

♦ Most of it is rural, but it has a number of towns and cities.
    Look at the map.

♦ At its heart is Chongqing city, which sits at the confluence
    of two rivers: the mighty Yangtze, and the Jialing.

♦ Chongqing city is an inland port. Big ships can travel up
    the Yangtze, all the way from Shanghai (2380 km away).

♦ In and around the city are all kinds of industries, making
    steel, cars, textiles, chemicals, computers, and much more.

♦ In the rural areas people grow rice and oranges, and there
    are many pig farms.

Map of Chongqing

Key
● main city
· other towns and cities
~ rivers

Jialing
Yangtze
Yangtze
Chongqing City

The world's fastest growing urban area

Chongqing city is at the heart of the world's fastest growing urban area.
If you start in the city centre and drive for an hour in any direction, you'll see
high rise buildings everywhere. Look at these figures:

♦ *Every day*, building work is completed on an area of land the size of 23
    football fields. Flats, offices, shops, factories.

♦ *Every day*, around 1300 people move from rural areas to live in this urban
    area. That's almost half a million people a year.

♦ *Every day*, more new businesses start up – and that means work for people.

Why no slums?

In other countries, fast growth has led to slums full of poor people.
But not in Chongqing. That's because China has planned ahead. It has built
lots of flats, and there is plenty of work. New arrivals can soon begin to earn.

Of course there are some run-down buildings in the city. (These are being
cleared away.) There are also many people who earn very little.

A

▶ *Up go more new buildings.*

▲ *The Chongqing urban area. It is at the confluence of the Yangtze and Jialing rivers.*

Focus on industry

More and more companies are setting up in Chongqing, including companies from the UK. Why?

◆ Land is much cheaper than in the east of China, and wages are lower.

◆ The government has made it easy for anyone to start a business there.

◆ Most things made in Chongqing are intended for sale in China, rather than for export. China is a huge market.

Where next?

The Chongqing urban area keeps on spreading. Built-up districts around the edges of the city are joining together. So the city will be at the centre of a **megalopolis** – perhaps the biggest in the world.

▲ *More cars for China ... made in Chongqing.*

Your turn

1 Where in China is the area called Chongqing?

2 The city of Chongqing is at the *confluence* of two rivers.
   a Explain what the word in italics means.
   b Which two rivers meet at Chongqing?
   c Which of them is the main river?
   d When two rivers join, the lesser one is called a *t......*?

3 Look at photos **A** and **B**. See how much you can tell about Chongqing city from them. Observe!

4 Chongqing was chosen to help develop the west of China. Explain why its location makes it a good choice.

5 China thinks factories are essential for its development. See if you can explain how a new car factory like the one in **C** can help to make life better for people.

6 a The urban area centred on Chongqing city is becoming a megalopolis. What's a *megalopolis*?
   b See if you can name another megalopolis. (Guess?)

Find out what life is like for some people in the Chongqing area.

The trouble with hukou

Every day, people from rural areas move into urban Chongqing to live. But their status, or **hukou**, remains *rural* – and they do not have the same rights as city people. This is left over from the days of Mao. He wanted people to stay on the land, so he made it hard to move to the city.

Most people think the hukou system is unfair. So it is being changed (slowly).

Now let's meet some people who live in Chongqing.

Liu Jian, a bang-bang man

I've been here five years now. I come from a village in Youyang.

Youyang is a poor place. So I had to come here to earn money. I have no skills. So I got a pole and some rope and became a bang-bang man. (*Say Bong-bong.*)

They say Chongqing has 100 000 bang-bang men. People need us because some streets are so steep. Some have lots of steps. When someone shouts 'Bang-bang' I come running.

At first ten of us lived in a small room. Now I stay in the low-cost flats. The rent is good. There are four of us in a room.

So I can send money to my wife. She's on the farm with our son. It takes me about 7 hours to get home. I go every few months.

Wang Hua, factory worker

I assemble special switches! I worked in a noodle bar first but I prefer this, and it pays better.

My husband Tien Lok works in the car factory. We rent a flat with two friends.

Kang is our son. He's three. We left him with Lok's mum in our village, 150 km from here. I miss him so much.

But if he came here, we couldn't get him into a good school. Or even find a good doctor. When you're from a rural area, like us, you do not have full rights in the city. It's not fair.

But things are changing in Chongqing. We know some people who got urban hukou. (*Say hoo-koo.*) Maybe we'll get it too. That would be fantastic.

Wu Shan, restaurant owner

I'm so happy. I've just opened my second restaurant.

I have to thank the Yangtze! We were moved here when they started the Three Gorges dam. Our village was to be drowned. I was still at school. It was a big change for me.

Anyway, when we came here, dad and mum set up a little street kitchen. They got really busy and I started helping out. I loved it.

So here I am, TWO restaurants. Chongqing is great. It's so lively. And people have more to spend these days.

We get lots of tourists too. They come up the Yangtze on cruise ships. They love Chongqing hotpot. It's my speciality. You should try it!

He Chan, a left-behind

I'm Chan. I'm ten. My mum and dad went to Chongqing city to work, so they left me behind in the village, with my gran. Children like me are called the left-behinds.

I love gran, but I miss mum and dad. When they come here they bring me lots of presents, and clothes. They always come for the Chinese New Year. That's the best time.

I talk to them on the phone a lot. They always ask about school, and have I done my homework. I try to get a good school report, to please them.

When I am older I will go to the city. I'll take gran with me. We can all be together. I'd like that so much.

Your turn

1   Who do you think has the hardest life, Jian (**A**) or Hua (**B**)? Explain.
2   Jian won't go back to his village until he is too old to work. Why not?
3   Explain what the hukou system is. (Glossary?)
4   Only one person in this unit has urban hukou. Which one do you think it is? (Give the person's first name.)
5   In what ways does the hukou system affect Hua?

6   China is reforming the hukou system – but only slowly.
    a   This will be good for the economy. Try to explain why.
    b   Why are they doing it *slowly*? See if you can explain.
7   China has over 60 million left-behind children like Chan.
    a   Why are they called *left-behind*?
    b   Now list the pros and cons of leaving children behind …
        i   from the parents' point of view
        ii from the childrens' point of view

Tops for biodiversity!

Southwest China is rich in plant and animal species. But is it all good news? Find out here.

China's most biodiverse region

Southwest China has an amazing range of plants and animals. It is China's most **biodiverse** region. In fact it is one of the most biodiverse regions in the world.

Under threat

Once, the region had many large forests. But as the number of people grew, more and more trees were cut down – for firewood, and timber, and to make way for farms, and towns, and roads.

So today, many species that live in the forests are in danger of extinction. There is not enough forest to support them.

▲ *It was once forest. Soon it will have crops.*

One victim: the giant panda

Pandas eat bamboo. Sichuan once had ample bamboo forests. But as these were cut down, the pandas had to move to higher land, where there's less bamboo. So their numbers fell. Now they are an **endangered species**.

But Sichuan wants to make sure they won't die out. A large area has been set aside for panda sanctuaries, where they are protected, and bred.

A panda experiment

The panda keepers aim to put some pandas back in the wild. So first, they choose a baby cub. As it grows, it is moved with its mum to different places, each wilder than the last – but all safe. The mum teaches it how to climb trees, and find food, and avoid danger.

When it is two, it is brought to a place where there are wild pandas, and set free. It has a GPS collar, so it can be tracked.

Biodiversity in Southwest China

SICHUAN
CHONGQING
TIBET
Tropic of Cancer
GUIZHOU
YUNNAN

Key
⌒ special area for biodiversity
🐾 pandas found here
🔴 Asian elephants found here

▼ *Spot the panda! This cub is destined for freedom.*
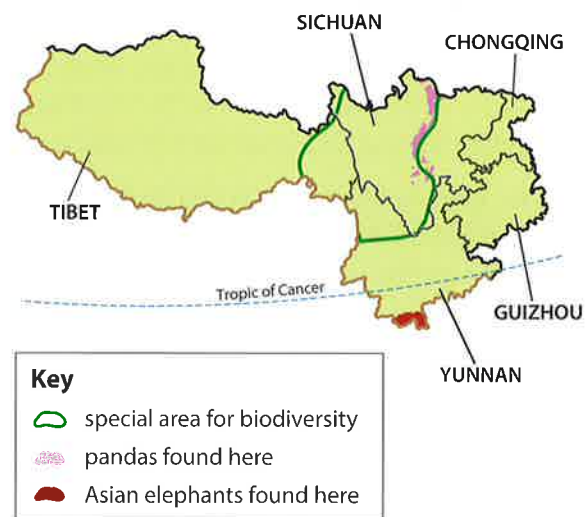
▼ *Yunnan is the only place in China with Asian elephants.*

It's not just pandas …

Other species in the Southwest region are endangered too. Including these …

▲ The golden monkey. It also lives in bamboo forests. So it shares the pandas' reserves in Sichuan.

▲ The snow leopard. It roams the rugged mountains in the Southwest region. It is mostly at risk from hunters.

Tackling deforestation

Deforestation is a problem everywhere in China, not just the Southwest. This is what China is doing to tackle the problem.

- ◆ Illegal loggers get 7 years in prison, if they are caught.
- ◆ Millions of new trees are being planted all over China. Farmers are paid to plant them, and look after them.
- ◆ China has set aside forest areas for reserves, where wildlife is protected.

But in the Southwest, it may be too late to save some species in the old forests.

Yunnan's rubber plantations

In the very south of Yunnan there's a different problem. It has rainforest. And lots of it has been cut down – to plant rubber trees. The rubber is for car tyres. The wildlife can't live in rubber plantations. So it has gone.

The local people depend on rubber for a living. As China's car industry grows, they earn more. So the local leaders would like even more plantations!

▲ A cut is made in the trunk of the rubber tree, and the white liquid that drips out is collected. It is natural rubber.

Your turn

1 The Southwest region is famous for its biodiversity. But now some species are endangered. Explain the terms in blue.

2 oratftoisdene means 'cutting down forests'. Unjumble it!

3 The people who prepare a panda cub for the wild wear panda suits that smell of panda. See if you can guess why.

4 Yunnan is the only place in the Southwest region that has rainforest. Why is rainforest found here?

5 Look at the photo with the rubber trees. See if you can explain why rubber plantations have little or no wildlife.

6 Why bother protecting pandas and other species?

It's the highest part of the Southwest region, and it has fewest people. Find out more about Tibet here.

Tibet: on the roof of the world

Tibet sits on the **Plateau of Tibet**.

This vast plateau is over 10 times bigger than the UK, and over 4.5 km high, on average. It is called the **Roof of the World.** It extends beyond Tibet, into China's Northwest region.

At the southern edge of the plateau, on Tibet's border, the Himalayas begin.

What's Tibet like?

- Tibet is cold in winter and cool in summer. The highest parts are always cold. The wind can be vicious.
- Much of it is tundra, with a layer of frozen soil, and no trees.
- But there are also some fertile valleys, good for farming.
- Tibet is dry for nine months of the year, because it is sheltered by the Himalayas. It gets some monsoon rain from the east in summer. The colder higher parts have snow and hail.
- It has *thousands* of glaciers and lakes.
- Several famous rivers rise on the Plateau of Tibet, and most flow through Tibet. There is more about them in Unit 8.9.

▲ Lhasa, the capital of Tibet. About 260 000 people live in the city. It is one of the world's highest cities (3490 m). Some tourists get altitude sickness.

▼ The Himalayas, from space. Tibet sits on the Plateau of Tibet. Look at all the lakes. The pale blue ones are frozen. White shows ice and snow on higher land. The Himalayas rise above the plateau. Look at all the rivers running south from the Himalayas.

▲ Harvesting barley in Tibet. The river – the Yarlung Tsangpo – will become India's Brahmaputra River.

▲ The North Face of Everest, in Tibet. Mount Everest sits on the border between Tibet and Nepal.

What about the people?

◆ Tibet has only 3 million people. It is the least densely populated area of China. (2.2 people per sq km.)

◆ Most are from the Tibetan ethnic group. (Tibetans also live on the rest of the plateau – outside Tibet – and in other areas that border it.)

◆ Tibet has a number of small cities and towns. But most people live in rural areas, and are farmers.

◆ In the fertile river valleys they grow barley and other grain crops, and fruit and vegetables.

◆ In the colder areas, yaks, horses, goats, and sheep are raised. People used to travel with them to find pasture, and live in tents. They were **nomads**. (See the next unit.)

◆ The Tibetan people are Buddhists. Their religion is very important to them.

▲ Buddhist monks in the snow.

All change in Tibet

Find out here how Tibet is changing.

Tensions in Tibet

Tibet was not always part of China. Before 1950 it was a separate country, under a Buddhist spiritual leader called the Dalai Lama.

In 1950 the Chinese army moved into Tibet. At first, China and Tibet agreed that the army would have a base there, but not interfere in how Tibet was run. However in 1959 China took full control. The Dalai Lama fled to India.

Many Tibetans want to be free of China. Sometimes they hold protests. People around the world also protest on their behalf.

Developing Tibet

China is working to develop Tibet.

- **Transport infrastructure** China has built Tibet's very first railway, linking Lhasa to Golmud. (Map **A**). It is now being extended.

  Several new highways and two more airports will be completed by 2020. (In 2014, Tibet already had four airports.)

- **Mining** China has surveyed Tibet and found that it has oil, gas, and many metal ores. If they are all exploited, Tibet will have a lot of industry.

- **Rivers** Another resource which Tibet has is rivers. Find out how they are being exploited in Unit 8.9.

- **Land** By January 2014, China had moved Tibet's 2.3 million nomads into resettlement villages. They said it was to protect the fragile tundra. (Critics say China wants the land for its own projects.)

▲ The Sichuan-Tibet Highway. It is one of the world's most dangerous roads – but the views are spectacular. It was opened in 1954.

▲ Yaks are reared in Tibet for milk, meat, leather, hair, and transport.

A
▲ You can take the train all the way from Lhasa to Beijing, the capital of China. Journey time: 48 hours. The new stretch of railway is in pink.

◀ Watching the train go by. The train carries oxygen for each passenger, and there is always a doctor on board.

How life changed for the nomads

For perhaps 4000 years, Tibet's nomads lived in tents, and moved around with their animals. Not any more.

Bemba Sonam's story

Bemba Sonam sits in his home, wondering what to do.

He used to be a nomad. He had spent his days travelling with his yaks to find pasture. He had taught his children how to look after the yaks, and where the best grazing was, and how to cope with harsh weather.

Then officials forced the family to sell their yaks, and move here!

'They said we had ruined the land by overgrazing. Our lives would be much better in a nice new home. There'd be lots of work for us. We might even be able to buy a car.'

'It has not turned out like that. Sometimes I get work on a building site. But I've not done this kind of work before and I don't like it. Anyway, all the Han Chinese who are moving into Tibet get most of the jobs.'

'We used to be free, under the sky. We had meat every day, and drank yak milk tea. Now we have to pay for everything. We are in prison.'

Some nomads will be happy with the change, and think life has improved. (But people usually prefer to have a choice.)

What about the yaks and other animals? China still wants them to be reared, but in a more organized way, without nomads roaming everywhere.

What about the future?

China is pumping billions of yuan into Tibet. Tibet depends on this money. Apart from agriculture and tourism, it does not earn much for itself.

But something else is happening, which may affect future plans. Most of the glaciers on the Tibetan Plateau are receding, and the permafrost is beginning to melt, because of global warming. Nobody knows what the results will be.
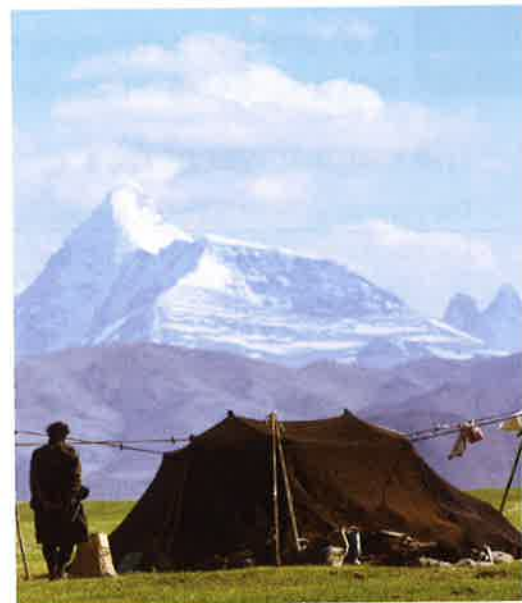
▲ A nomad and his tent. It is made of yak hair.

▼ A resettlement village for nomads.

Did you know?
- Tibetans don't usually have surnames.
- So everyone in the family can have different names.

Your turn

1 The building of the railway into Tibet is counted as a wonderful feat of engineering. See if you can explain why.

2 a Part of the railway line is built on *permafrost*. What's that?
  b The permafrost may lead to a problem in the future. Why?

3 China aims to turn Tibet into a big tourist destination. Which of the changes described in this unit will help China to achieve that aim?

4 China says that Tibet's new railways, roads, and airports will help to keep China *secure*. In what way?

5 Which do *you* think would be better: life on the move with your yaks, or life in the village in the photo above?

6 How might life be different for Bemba Sonam's children than it was for him?

7 Now write a 50-word advert to attract tourists to Tibet.

Find out about the big rivers that flow through the Southwest region – and China's plans for building dams on them.

The water tower of Asia

The Plateau of Tibet is called the water tower of Asia. Map A shows why. The rivers are fed by melting glaciers.

A **Major rivers from the Plateau of Tibet**

PLATEAU OF TIBET

Huang He (Yellow River)

Indus

Yangtze

Ganges Brahmaputra

Irrawaddy

Salween

Mekong

ARABIAN SEA

Bay of Bengal

ANDAMAN SEA

INDIAN OCEAN

PACIFIC OCEAN

SOUTH CHINA SEA

0   1100 km

Key
- countries
- high plateau
- rivers
- Southwest China boundary

Look how many of the rivers rise in, or flow through, the Southwest region (inside the dotted line).

China's plans for dams

Now look at map **B**. It shows dams which China has built already, or plans to build, on these rivers. Most of the dams are in the Southwest region.

The electricity from the dams will fuel factories and homes. So fewer new coal-burning power stations will be needed. (These are a big source of pollution.)

But the countries which share rivers with China are uneasy. They depend on them for water. They worry that China will use the dams to control the flow of water, or even to divert water to other parts of China.

B | **Dams on the rivers**

Key

▲ dams, existing or under construction
△ dams, proposed
— high plateau
〜 rivers
···· Southwest China boundary

Did you know?

◆ The Yangtze is one of the world's busiest rivers ...
◆ ... carrying cargo and passenger ships between Chongqing and the coast.

Other concerns

People in China, and outside, have other concerns too.

◆ **Loss of land**   When a dam is built, a big lake forms behind it. So people living around the site have to move away. The lake will drown their land.

When the famous dam in **C** was built, over 1.3 million people were moved. Many were moved upstream to Chongqing city (like Shan on page 129).

◆ **Effect on wildlife**   Along the river, trees are chopped down to make room for dams. In the river, habitats of fish and other life are destroyed.

◆ **Earthquake risk**   Many of the proposed dams are in areas with a high risk of earthquakes. If a dam cracks, there could be a catastrophic flood.

◆ **Global warming**   The big one! Most of the glaciers on the Plateau of Tibet show signs of melting. As time goes on, the rivers will have less water.

So China's plans for dams are controversial. Some of the planned dams may be cancelled. You are sure to hear more about them in the years ahead.
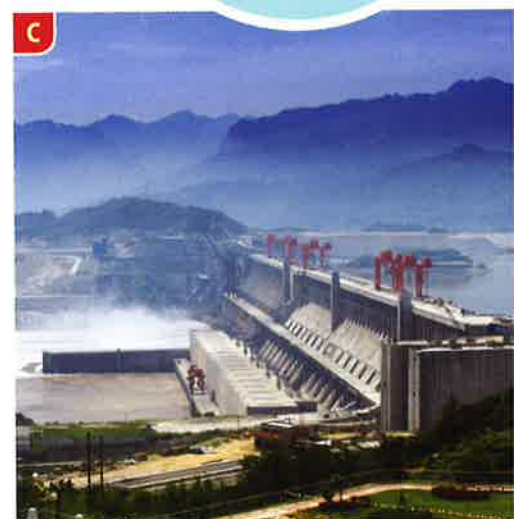
▲ The Three Gorges dam on the Yangtze, over 600 km from Chongqing. Ships pass it using locks. There's also a special lift for ships – the biggest lift in the world.

Your turn

1 **a** Name the major rivers that rise on the Plateau of Tibet.
   b Underline the ones that flow only in China.

2 Most of the rivers in map **A** are *transnational*. (Glossary?) Choose two of the transnational rivers, and say which countries they flow through.

3 China wants the dams mainly for hydroelectricity.
   a What is *hydroelectricity*?
   b The dams will help China's economy. In what way?

4 China also says that the dams will help the environment.
   a In what way will they help the environment?
   b In what ways do dams *harm* the environment?
   c In what ways may they harm people?

5 Some of the concerns about the dams are more serious than others. Put them in what you think is their order of importance, most serious first. (Don't forget the ones on page 136.)

6 Update that spider diagram!

Ordnance Survey Symbols

ROADS AND PATHS 1: 25 000

M I or A 6(M)	Motorway
A 35	Dual carriageway
A 30	Main road
B 3074	Secondary road
	Narrow road with passing places
	Road under construction
	Road generally more than 4 m wide
	Road generally less than 4 m wide
	Other road, drive or track, fenced and unfenced
	Gradient: steeper than 1 in 5; 1 in 7 to 1 in 5
Ferry	Ferry; Ferry P – passenger only
	Path

PUBLIC RIGHTS OF WAY

1:25 000	1:50 000	
		Footpath
		Bridleway
+++++		Byway open to all traffic
	-+-+-+-	Restricted bridleway

RAILWAYS 1: 25 000

	Multiple track
	Single track
	Narrow gauge/Light rapid transit system
	Road over; road under; level crossing
	Cutting; tunnel; embankment
	Station, open to passengers; siding

BOUNDARIES 1: 50 000

	National
	District
	County, Unitary Authority, Metropolitan District or London Borough
	National Park

HEIGHTS/ROCK FEATURES 1: 50 000

	Contour lines
· 144	Spot height to the nearest metre above sea level

outcrop   cliff   scree

ABBREVIATIONS 1: 25 000 and 1: 50 000

PO / P	Post office	PC	Public convenience (rural areas)
PH	Public house	TH	Town Hall, Guildhall or equivalent
MS	Milestone	Sch	School
MP	Milepost	Coll	College
CH	Clubhouse	Mus	Museum
CG	Cattlegrid	Cemy	Cemetery
Fm	Farm	Hosp	Hospital

ANTIQUITIES 1: 25 000 and 1: 50 000

VILLA	Roman	✕	Battlefield (with date)
Castle	Non-Roman	☆	Visible earthwork

LAND FEATURES 1: 25 000 and/or 1: 50 000

ruin	Buildings
	Public building
	Bus or coach station
	Place of Worship (current or former) — with tower / with spire, minaret or dome / without such additions
°	Chimney or tower
	Glass structure
Ⓗ	Heliport
△	Triangulation pillar
	Mast
	Wind pump / wind turbine
	Windmill
+	Graticule intersection
	Cutting, embankment
	Quarry
	Spoil heap, refuse tip or dump
	Coniferous wood
	Non-coniferous wood
	Mixed wood
	Orchard
	Park or ornamental ground
	Forestry Commission access land
	National Trust – always open
	National Trust, limited access, observe local signs
	National Trust for Scotland

TOURIST INFORMATION 1: 25 000 and/or 1: 50 000

P	Parking
V	Visitor centre
i	Information centre
	Recreation/leisure/ sports centre
	Telephone
	Camp site/ Caravan site
	Golf course or links
	Viewpoint
PC	Public convenience (toilet)
	Picnic site
	Pub/s
	Cathedral/Abbey
	Museum
	Castle/fort
	Building of historic interest
	English Heritage
	Garden
	Nature reserve
	Water activities
	Fishing
☆	Other tourist feature

WATER FEATURES 1: 25 000 and/or 1: 50 000

Marsh or salting   Slopes   Cliff   High water mark
Towpath   Lock   Flat rock   Low water mark
Aqueduct   Canal   Ford   Lighthouse (in use)
Weir   Normal tidal limit   Sand   Lighthouse (disused)   Beacon
Lake   Bridge   Dunes   Mud   Shingle
Footbridge
Canal (dry)

Map of the British Isles

Key

- ------ international boundary
- ——— national boundary
- ～～ river
- lake
- ▲ highest point in the UK

towns
- ■ largest cities
- ● large cities and towns

Land height
measured in metres above sea level

- more than 1000 m
- 500 - 1000 m
- 200 - 500 m
- 100 - 200 m
- less than 100 m
- land below sea level

Scale

1: 4 500 000

One centimetre on the map represents 45 kilometres on the ground.

0   45   90   135   180 km

Transverse Mercator Projection
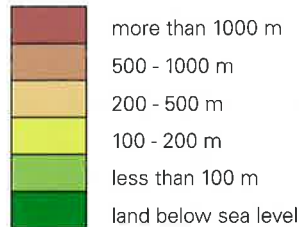

Shetland Islands

Orkney Islands

Cape Wrat

John o'Groats

Outer Hebrides

Lewis

Harris

Skye

NORTHWEST HIGHLANDS

River Spey

Loch Ness

Great Glen

CAIRNGORMS

River Dee

Aberdeen

1344m Ben Nevis

GRAMPIAN MOUNTAINS

Mull

R. Tay

SCOTLAND

Dundee

Loch Lomond

Stirling

Firth of Forth

Glasgow

Islay

Edinburgh

R. Clyde

UNITED KINGDOM

SOUTHERN UPLANDS

R. Tweed

CHEVIOT HILLS

Firth of Clyde

North Channel

NORTHERN IRELAND

ANTRIM MOUNTAINS

R. Bann

Lough Neagh

Belfast

River Erne

Newcastle upon Tyne

River Tyne

Sunderland

Stockton-on-Tees

Middlesbrough

LAKE DISTRICT

River Eden

River Tees

PENNINES

NORTH YORK MOORS

Isle of Man

River Ouse

York

REPUBLIC OF IRELAND

Lough Corrib

R. Boyne

R. Liffey

Dublin

WICKLOW MOUNTAINS

River Shannon

River Barrow

River Suir

River Blackwater

Cork

NORTH ATLANTIC OCEAN

Irish Sea

Blackpool

Bradford

Leeds

Kingston-upon-Hull

Preston

Huddersfield

River Aire

Bolton

Manchester

Stockport

Sheffield

Liverpool

Warrington

River Mersey

ENGLAND

River Humber

Anglesey

Stoke-on-Trent

R. Dee

R. Trent

Derby

Nottingham

The Wash

R. Hansum

Happisb

CAMBRIAN MOUNTAINS

Telford

Walsall

Leicester

THE FENS

Norwich

Cardigan Bay

Wolverhampton

Birmingham

Peterborough

Dudley

Coventry

Solihull

Northampton

R. Great Ouse

Ipswich

WALES

River Teifi

R. Wye

R. Avon

Milton Keynes

R. Stour

River Tywi

River Usk

BRECON BEACONS

R. Severn

CHILTERN HILLS

Luton

Basildon

Southend-on-Sea

Newport

COTSWOLD HILLS

R. Thames

London

Swansea

Cardiff

Reading

NORTH DOWNS

Bristol

SALISBURY PLAIN

Bristol Channel

SOUTH DOWNS

Strait of Dover

EXMOOR

R. Exe

Southampton

Brighton

NORTH ATLANTIC OCEAN

Bournemouth

Poole

Portsmouth

Isle of Wight

DARTMOOR

Newquay

Torbay

Plymouth

Isles of Scilly

Land's End

English Channel

North Sea

NORTH SEA

St George's Channel

139

— international boundary
• capital city

abbreviations
BELG.	BELGIUM
B-H.	BOSNIA-HERZEGOVINA
C.	CROATIA
CENT. AF. REP.	CENTRAL AFRICAN REPUBLIC
CZ.	CZECH REPUBLIC
F.	FYROM (Former Yugoslav Republic of Macedonia)
K.	KOSOVO
LITH.	LITHUANIA
MT.	MONTENEGRO
LUX.	LUXEMBOURG
NETH.	NETHERLANDS
S.	SLOVENIA
SE.	SERBIA
SL.	SLOVAKIA
SWITZ.	SWITZERLAND
U.A.E.	UNITED ARAB EMIRATES
U.S.A.	UNITED STATES OF AMERICA

Equatorial Scale 1: 95 000 000

Did you know?
◆ Earth is 4600 million years old.
◆ It weighs 6000 million million million tonnes.

Arctic Circle
Bering Strait
Alaska (U.S.A.)
GREENLAND (Den.)
Nuuk (Godthåb)
Reykjavik

C A N A D A
Ottawa

U. S. A.
Washington D.C.
Azores (Port.)
Bermuda (U.K.)

Tropic of Cancer
Hawaiian Is. (U.S.A.)
MÉXICO
México
Havana
CUBA
Nassau
THE BAHAMAS
JAMAICA
Kingston
HAITI
DOMINICAN REPUBLIC
Puerto Rico (U.S.A.)
ST. KITTS NEVIS
ANTIGUA & BARBUDA
DOMINICA
ST. LUCIA
ST. VINCENT & THE GRENADINES
BARBADOS
GRENADA
CAPE VERDE IS.
Belmopan
BELIZE
GUATEMALA
HONDURAS
Guatemala
San Salvador
EL SALVADOR
Tegucigalpa
NICARAGUA
Managua
San José
COSTA RICA
Panama
PANAMA
TRINIDAD AND TOBAGO
Caracas
VENEZUELA
GUYANA
Georgetown
Paramaribo
SURINAME
Cayenne
FRENCH GUIANA (Fr.)
Bogotá
COLOMBIA

Equator
Galapagos Is. (Ec.)
Quito
ECUADOR
P E R U
Lima
B R A Z I L
Brasília
La Paz
BOLIVIA

Tokelau Is. (N.Z.)
American Samoa (U.S.A.)
SAMOA
French Polynesia (Fr.)
TONGA
Niue (N.Z.)
Cook Is. (N.Z.)
Pitcairn Is. (U.K.)

Tropic of Capricorn
PARAGUAY
Asunción
A R G E N T I N A
C H I L E
URUGUAY
Santiago
Buenos Aires
Montevideo
Falkland Is. (U.K.)
Stanley
South Georgia (U.K.)

North America
NORTH ATLANTIC OCEAN
Europe
Asia
PACIFIC OCEAN
PACIFIC OCEAN
Africa
South America
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
Oceania
SOUTHERN OCEAN
Antarctica

The continents and oceans

Amazing – but true!

- Nearly 70% of Earth is covered by saltwater.
- Nearly 1/3 is covered by the Pacific Ocean.
- 10% of the land is covered by glaciers.
- 20% of the land is covered by deserts.

World champions

- Largest continent – Asia
- Longest river – The Nile, Africa
- Highest mountain on land – Everest, Nepal
- Highest mountain in the ocean – Mauna, Hawai
- Largest desert – Sahara, North Africa
- Largest ocean – Pacific

Did you know?
The world has:
- over 190 countries
- over 7 billion people
- over 6000 different languages

Glossary

A

abrasion – scraping away material

aerial photo – a photo taken from the air

air mass – a huge block of air moving over Earth; it can be warm or cold, damp or dry, depending on where it came from

air pressure – the force pressing down on us because of the weight of the atmosphere

altitude – height of a place above sea level

anemometer – use it to measure wind speed

arch – the curved structure left when the sea erodes the inside of a cave away

atmosphere – the layer of gas around Earth

B

barometer – use it to measure air pressure

bay – a smooth curve of coast between two headlands

beach – an area of sand or small stones, deposited by waves

beach replenishment – adding sand to a beach to replace the sand the waves carried away

biodiverse – has many different species of plants and animals

biome – a very large area with a similar climate, plants, and animals

C

capital city – the city where the country's government is based

climate – what the weather in a place is usually like, over the year; they take measurements over long periods and calculate the average

climate change – all aspects of climate are changing because Earth is getting warmer

coast – where the land meets the sea

coastal defences – barriers to protect the coast from erosion or flooding

condense – to change from gas to liquid

confluence – where two rivers join

coniferous – describes trees which bear cones (such as pine trees)

continent – one of Earth's great land masses; there are seven continents

convectional rainfall – the Sun heats the ground, convection currents of warm air rise, the water vapour condenses, and rain falls

correlation – a relationship or connection between two different things

country – humans have divided continents into political units called countries

D

dam – a structure built across a river to control water flow; it usually contains turbines which the water spins, generating electricity

data – information collected for a purpose; for example, names and addresses

deciduous – describes trees which lose their leaves in winter

decline – to fall gradually into a poor state

deforestation – cutting down forests

densely populated – lots of people live there

deposit – to drop material; waves deposit sand and small stones to form beaches

depression – a weather system made up of a warm front chased by a cold one; it brings wet windy weather

desalinate – to turn seawater into fresh water that people can drink, by removing its salt

desert – gets very little rain; it can be a hot or cold desert, and sandy or rocky

desertification – where fertile land becomes like a desert, through overuse or drought

drought – there is less rain than usual, so there is not enough water for our needs

E

earthquake – the shaking of Earth's crust, caused by sudden rock movement

economic – about money and business

economy – all the business activity going on in a country

emissions – waste gases that go into the air, for example from car exhausts

endangered – when so few of a species are left that it's in danger of extinction; for example snow leopards are endangered

environment – everything around you; air, soil, water, animals, and plants form the natural environment

Equator – an imaginary line around the middle of Earth (at 0° latitude)

erosion – the wearing away of rock, stones and soil by rivers, waves, wind, or glaciers

exploit – to make use of a place, or people, or things, for your own benefit

exports – things a country sells to other countries

F

favela – a slum in a South American city

fetch – the length of water the wind blows over, before it meets the coast

flood defences – structures built to prevent flooding; for example an embankment

fossil fuel – coal, oil, natural gas

front – the leading edge of an air mass; a warm front means a warm air mass is arriving

frontal rainfall – rain caused by a warm front meeting a cold one

fuels – thing we use to provide energy; we usually burn them (but not nuclear fuel)

G

GDP (gross domestic product) – the total amount that the population of a country earns in a year

GDP per person – the GDP divided by the population; it's a measure of how wealthy the people are, on average

GDP per person (PPP) – the GDP per person is adjusted to take into account that things cost more in some places than others

glacier – a river of ice

global warming – the rise in average temperatures around the world

gravity – the force of attraction that draws things towards Earth

grazing – land with grass and other vegetation, where animals can feed

greenhouse gases – they trap heat around Earth

groynes – barriers of wood or stone down a beach, to stop sand being washed away

gulf – a large area of ocean that is partly enclosed by land

H

headland – land that juts out into the sea

hukou system – in China you have rural or urban hukou (status) depending on where you were born; if your hukou is rural, you don't have full rights in the city

hunter gatherers – they lived by hunting animals and collecting fruit and seeds

hydroelectricity – electricity generated when flowing water spins a turbine, at a dam

I

ice age – when Earth's average temperature is lower than usual, and glaciers spread

imports – things bought in from other countries

independence – when a country that had been a colony begins to govern itself

Industrial Revolution – the period (about 1760 – 1840) when many new machines were invented, and many factories were built

inequality – the unequal sharing of wealth in a society

international – concerns more than one country

K

karst – landscape features that form when rock such as limestone is attacked by acidic rain (containing dissolved carbon dioxide)

L

landform – a feature formed by erosion or deposition (for example a bay)

latitude – how far a place is north or south of the Equator; it is measured in degrees

leeward – sheltered from the wind

life expectancy – how many years a new baby can expect to live for, on average

logging – cutting down trees for timber

longitude – how far a place is east or west of the Prime Meridian; it is measured in degrees

longshore drift – how sand and other material is carried parallel to the shore, by the waves

M

mangroves – trees that grow in salty swamps along the coast

manufacturing – making things in factories

megalopolis – a very large urban area made of a chain of built-up areas

metal ores – rocks from which metals are extracted

migrant – a person who moves to another part of the country, or another country, usually to work

monsoon rains – they fall in summer in some regions, when moist winds are drawn in from over the ocean

N

national – to do with all of one country

natural – occurs without human involvement

nomad – a person who rears animals, and travels with them to find grazing

non-renewable resource – a resource we will run out of one day; for example oil

North Atlantic Drift – a warm current in the Atlantic Ocean; it keeps the weather on the west coast of Britain mild in winter

Northern Hemisphere – the half of Earth above the Equator

O

ocean currents – currents of water in the ocean, that are warmer or colder than the water around them

P

peninsula – land that juts out into the sea, and is almost surrounded by water

permafrost – the ground under the surface that is permanently frozen, in the tundra

plateau – an area of fairly flat high land

population – how many people live in a place

population density – the average number of people living in a place, per square kilometre

population distribution – how the people in a country are spread around

populous – has a large population

postcode – a set of numbers and letters which are added to an address to help mail delivery

precipitation – water falling from the sky (as rain, sleet, hail, snow)

prevailing wind – the wind that blows most often; in the UK it is a south west wind

primary sector (of the economy) – where people earn a living by collecting things from the Earth (farming, fishing, mining)

pull factors – factors that attract people to a place (for example, better wages)

push factors – factors that push people out of a place (for example, there's no work there)

PV cell – converts sunlight into electricity

R

rainforest – has lush vegetation, with many different species of plants and animals

regenerate – to restore an area that was in a poor state, and bring it back to life

relief – how the height of the land varies

renewable resource – a resource that we can grow or make more of; for example wood

republic – does not have a king, queen, or emperor

resources – things we need to live, or use to earn a living; for example food, fuel

rural area – an area that is mainly countryside; it may have villages and small towns

S

salt marsh – a low-lying marshy area by the sea, with salty water from the tides

secondary sector (of the economy) – where people earn a living by making things, mostly in factories

secure – safe from attack

settlement – a place where people live; it could be a hamlet, village, town or city

shanty town – a poor area where the houses are just shacks; another term for slum

shingle – small pebbles

slum – area of very poor housing

sparsely populated – not many live there

species – a type of plant or animal

social – about people and society

software – computer programmes

solar power – when we use sunlight to generate electricity (via PV cells)

sparsely populated – few people live there

speculators – they take a risk, and spend money in the hope of making lots of profit

spit – a strip of sand or shingle in the sea

stack – a pillar of rock left standing in the sea when the top of an arch collapses

steppe – a large flat area of treeless grassland

storm surge – change in sea level caused by a storm

stump – the remains of an eroded stack

sustainable – can be carried on into the future without harming people's quality of life, or the economy, or the environment

T

taiga – region of coniferous forests which lies between the tundra and steppes

temperate – relating to a mild climate: not hot, not too cold

temperature – how hot or cold something is, measured in degrees Centigrade

tertiary sector (of the economy) – people provide services for other people

thermometer – use it to measure temperature

tidal range – the fall in sea level from high to low tide

tides – the rise and fall in sea level, due mainly to the pull of the moon

transnational – crosses country borders

transport – the carrying away of material by rivers, waves, the wind or glaciers

tree line – the line or altitude above which it's too cold for trees to grow

tributary – a river that flows into a larger one

tropics – the area between the Tropics of Cancer and Capricorn

tundra – a cold region where the ground is deeply frozen; only the surface thaws in summer, allowing small plants to grow

U

urban area – a built-up area (large town or city); it's the opposite of rural

urbanisation – the increase in the % of the population living in urban areas, as people move in from rural areas

W

water vapour – water in gas form

wave-cut notch – a notch cut in a cliff face by the action of waves

wave-cut platform – the flat rocky area left behind when waves erode a cliff away

weather – the state of the atmosphere at any given time – for example how warm it is

weathering – the breaking down of rock; it is caused mainly by the weather

wind – air in motion

wind direction – where the wind blows from

wind speed – how fast the wind is blowing

windward – facing into the wind

Index