4th edition

geog.3

geography for key stage 3

<rosemarie gallagher> <richard parish>

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Contents

Key for symbols in 'Your turn' questions

 Literacy  Numeracy

1 From rock to soil

The big picture

This chapter is about **rocks** and **weathering** and **soil**. Here's the big picture …

- Rock is made of natural compounds called **minerals**.
- There are many types of rock. But they all fall into just three groups, depending on how they were formed.
- Rock changes from one group to another.
- Over time, rock gets broken down to form soil.
- Different types of rock lead to different scenery.

Did you know?
- The land in the UK spent quite a lot of time at the Equator!

What if…
- … the UK moved back to the Equator?

Your goals for this chapter

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

- What is a *mineral*? Give at least three examples.
- What are the three groups of rock? And how were the rocks in each group formed? Name at least one rock in each group.
- What do these terms mean?
  weathering *physical weathering* *chemical weathering*
  freeze-thaw weathering *exfoliation*
- What is the *rock cycle*? You should be able to describe it, and sketch it.
- What are *plates*, and why do they move?
- The UK has rock which was formed in other parts of the world. Why?
- Why does the UK have mountainous areas?
- What type of bedrock does the UK have? You should be able to describe the general pattern.
- How does rock type influence the landscape? Give at least two examples.
- What do these terms mean?
  soil *humus* *topsoil* *nutrient* *fertiliser*
- How is soil formed? And why is it so important to humans?

Did you know?
- The oldest rock in the UK is 3 billion years old!
- The youngest is about 50 million years old.

Why…
- … is the rock in the UK all different ages?

Why…
- … is rock different colours (grey, white, red, pink, blue …)?

And then …

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

Your chapter starter

Look at the photo on page 4. What does it show?

Was it taken in the UK? Yes? No? Maybe?

How do you think those mountains were formed?

Do you think they'll look the same 20 million years from now?

Would you like to live near them, like the people in that village do? Why?

1.1 Your rocky home

What exactly is rock? Find out here.

It's everywhere!

Wherever you go, there's rock all around you. For example this shows Chapel Stile, a village in the Lake District. If you visit it, you'll find …

Did you know?

- Earth formed when dust, gases, and chunks of rock coalesced, after the birth of the Sun.

… mountains made of rock …

… rock hidden under the soil …

… roofs made of slate, a local rock …

… roads built from crushed rock …

… buildings made from blocks of rock …

Where's Rocky?

… and precious things obtained from rock … like the diamonds and gold in this ring.

… rock used inside homes – for example granite for worktops, and limestone for tiles …

And think about this. The people in Chapel Stile – and all of us – are made up of atoms of 61 different elements. Almost all came from rock, and reached us via food.

So what exactly is rock?

Rock is a mixture of **minerals**.

A **mineral** is a natural compound. It has a chemical name and formula, like the compounds you meet in science – but we usually use its *geological* name. Minerals usually exist in rock as **crystals**.

Look at these samples of rock:

Did you know?

- By far the most common atoms in rock are silicon and oxygen atoms.

Granite. The three colours tell us that this rock contains at least three minerals. The pale grey one is silicon dioxide or **quartz**, which is like glass. Each 'blob' is a cluster of crystals.

Sandstone. This rock is mainly quartz, often mixed with minerals called **feldspars** (made of silicon, oxygen, and other elements). A magnifying glass would help you see the crystals.

Limestone. It is mainly **calcite**, or **calcium carbonate**, often mixed with quartz and other minerals. Calcite is made from the shells of sea creatures. (Find out more later.)

The most common minerals

There are around 5000 known minerals. Most contain silicon and oxygen atoms.

But only about ten minerals are common. They are called the **rock-building minerals**. The most common of all are the feldspars, and quartz. Between them, they make up most of Earth's **crust** – the hard outer layer that you live on.

▶ *Uluru (Ayer's Rock) in Australia. Made of sandstone, with a high % of a feldspar that's rich in potassium. The feldspar gives the rock its red colour.*

Your turn

1 a What is *rock*?
  b Do you think there is rock under the ocean? Explain your answer.

2 Look at the photo on page 6.
  a Give at least five ways in which we humans use rock. The photo will help. (But try to think of others too.)
  b Where do we find the rock we need?

3 a What is a *mineral*?
  b What's the geological name for the mineral *silicon dioxide*?

4 Feldspars and quartz make up most of Earth's crust. These minerals have something chemical in common. What?

5 Help! A fungus has arrived from outer space. It is eating up rock! Write an article for a news website about how it is affecting people in the UK. At least 70 words. And dramatic!

1.2 The three rock groups

All rock belongs to one of three groups. Here you can find out about the groups, and what makes them different.

Putting rock into groups

There are lots of different kinds of rock, with different mixtures of minerals. But they fall into just three groups of rock – **sedimentary**, **igneous**, and **metamorphic**. Each group has been formed in a different way. Let's look at each in turn.

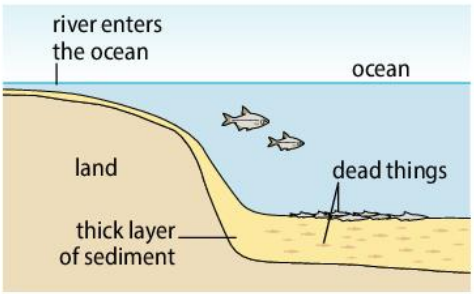
Did you know?

- Most fossils are found in sedimentary rock. (Dead things get buried in sediment.)

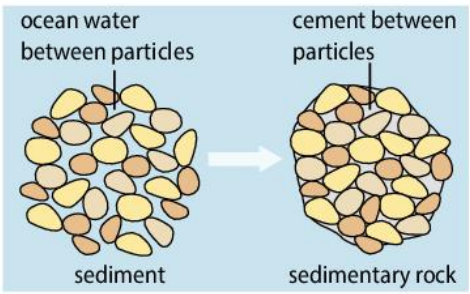
Sedimentary rock

This forms when particles of minerals which were eroded from rock in one place get stuck together again in another place, to form new rock.

For example, a river carries a load of particles eroded from rock in its banks and bed. It carries them to the ocean and dumps them. They fall …



… to the ocean floor as sediment. Over years the layer of sediment builds up. It could be hundreds of metres thick, and very very heavy.



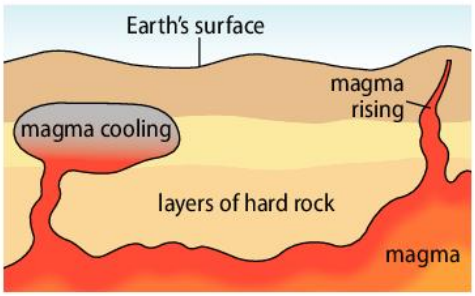
The weight causes the particles deep in the layer to get squeezed together. Substances dissolved in the water act as cement. The result: new rock!

Different sediments give different types of sedimentary rock. For example:

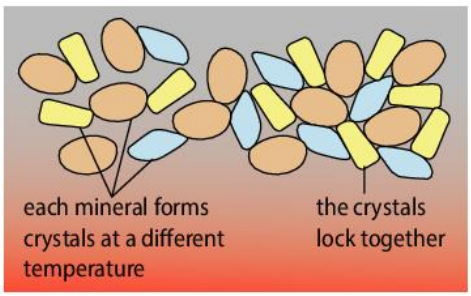
- a sediment of **mud** gives **mudstone**
- a sediment of **sand** gives **sandstone**
- a sediment of shells that pile up on the ocean floor gives **limestone**.

Igneous rock

This forms when rock melts, then cools and hardens again.



Far below the ground, it's so hot that the minerals in rock melt, giving a liquid called **magma**. The magma may then rise, cooling as it goes.



The magma may cool slowly below ground. The minerals form big crystals which lock together, forming rock such as **granite**. (See page 7.)

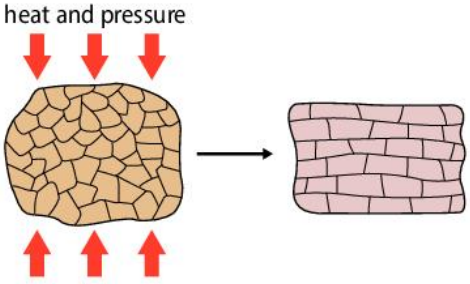
But some magma reaches the surface and shoots out at volcanoes as **lava**. This cools quickly to form rock such as **basalt**, with small crystals.

▲ *A fossil of a young dinosaur, in sandstone, found in China. It is 120 million years old. To reveal it, the rock was carefully chipped away.*

▲ *3.6 million years ago in Tanzania, Africa, a creature left footprints in volcanic ash. The ash became a sedimentary rock called **tuff**.*

Metamorphic rock

This is rock which has been changed underground, without melting.



Deep underground, it's hot, and the pressure can be enormous. Together, the heat and pressure can change rock *without* melting it.

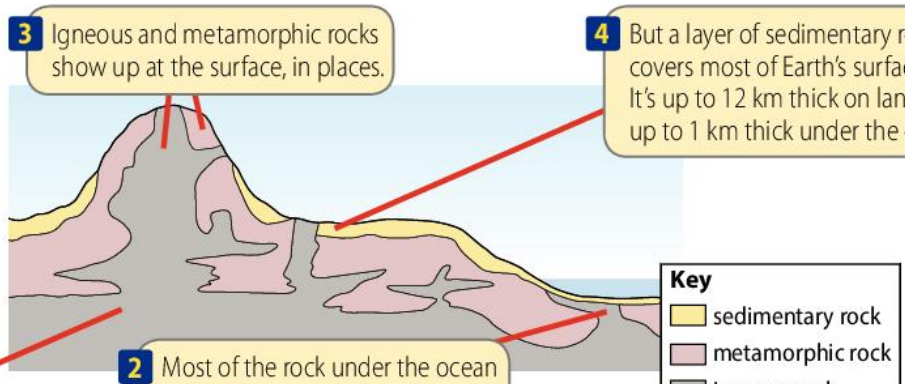
The structure of the minerals usually changes, so the rock looks different. For example this is the sedimentary rock **mudstone**. Underground, …

… heat and pressure cause it to metamorphose to **slate**, where the crystals are lined up in flat sheets. Slate is used to make roof tiles.

Where the rock groups are

Earth's crust is the hard outer layer, where you live. It is up to 65 km thick. (It's thickest at mountains!)

About 65% of the crust is igneous rock. Only about 8% is sedimentary. Look at this simplified cross-section.



Your turn

1 Most rivers carry **silt**, which is a mixture of particles smaller than sand grains, but bigger than the tiny particles in mud.
   a Draw a set of diagrams to show how, and where, silt could become sedimentary rock. (Page 8 will help.)
   b What do you think this rock is called?

2 Under high pressure, limestone will turn into **marble**. To which group of rocks does marble belong?

3 a There's no sedimentary rock deep in Earth's crust. Why?
   b Fossils in metamorphic rock are usually distorted. Why?
   c You won't find fossils in igneous rock. Suggest a reason.

1.3 Weathering

Over time, all rock at Earth's surface is broken down by weathering. How does that work ? Find out here.

What is weathering ?

Look at the rock in this photo. A few thousand years from now, it could be just stones and soil.

Why ? Because of a set of processes called **weathering**.

In weathering, rock is broken down by the action of things in its environment: by heat and cold, rain, gases from the air, and even by plants and animals.

Two kinds of weathering go on together: **physical weathering** and **chemical weathering**.

▲ *Weathering in progress in Scotland.*

1 Physical weathering

In physical weathering, the rock gets broken into bits – but the minerals in it *do not change*. Rock can be broken into bits in several ways.

1 By heating and cooling
Rock expands as it heats up in the sun, and contracts when it cools. Repeated heating and cooling can weaken it, and cause it to crack.

2 By freeze-thaw weathering
At 0 °C, any water in the cracks in rock freezes. It expands as it freezes, so the cracks get wider. Then when the ice thaws, and rain falls …

… these bigger cracks fill up with water. It freezes again … and thaws again. Each time the cycle repeats, the cracks get wider. Eventually the rock falls apart.

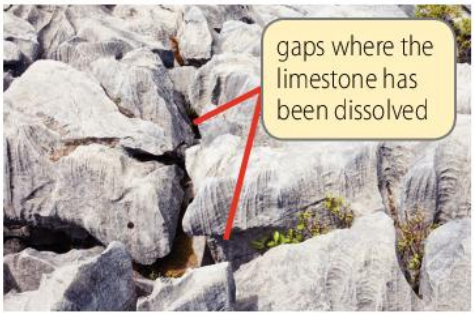
3 By a reduction in pressure
Rock deep underground is under pressure, due to the weight of the rock above it. But if the rock above it is eroded away, it is no longer …

… under pressure. So it expands. This causes it to split, parallel to the surface. Over time, layers break off, like layers of an onion. This process is called **exfoliation**.

4 By living things
Roots work their way into cracks in rock, and widen them. Burrowing animals can also make cracks bigger.

2 Chemical weathering

In chemical weathering, minerals in the rock undergo chemical reactions. So they change. This helps to weaken the rock, and break it up. Look at these examples.



Rain is slightly acidic. That's because it dissolves carbon dioxide from the air. So it reacts with the calcium carbonate in limestone, and dissolves it away.

The most common minerals in rock are the **feldspars** (page 7). Water reacts with these over time, giving **clay**. It is made of very fine particles. It's soft, and slippery when wet.

Quartz is also very common – but it resists chemical weathering. So when rock containing quartz breaks down, the quartz crystals are set free as sand. They end up on our beaches!

The end result

Together, physical and chemical weathering break rock down into stones, and sand, and clay, and compounds which dissolve in water and are carried away.

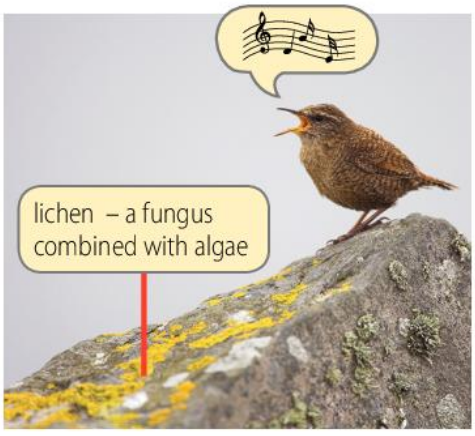
When the sand and clay are mixed with rotting vegetation, the result is **soil**. You can find out more about soil in Unit 1.8.

How quickly?

How quickly does rock break down? It depends on the climate, and the rock.

- Daily temperature changes from hot to cold, or temperatures that vary around 0 °C (the freezing point of water), promote physical weathering.
- Chemical weathering speeds up as the temperature rises. And it usually needs rain. So it is fastest in places with a warm damp climate.
- Some rock weathers more easily than others. For example, mudstone weathers much more easily than granite does.

So, depending on what and where it is, rock might form a thick layer of soil in a few hundred years … or show little weathering after a few thousand.



▲ *Some living things bring about both physical and chemical weathering. For example, lichen grows into cracks in rock, and also makes acids which eat into rock.*

Your turn

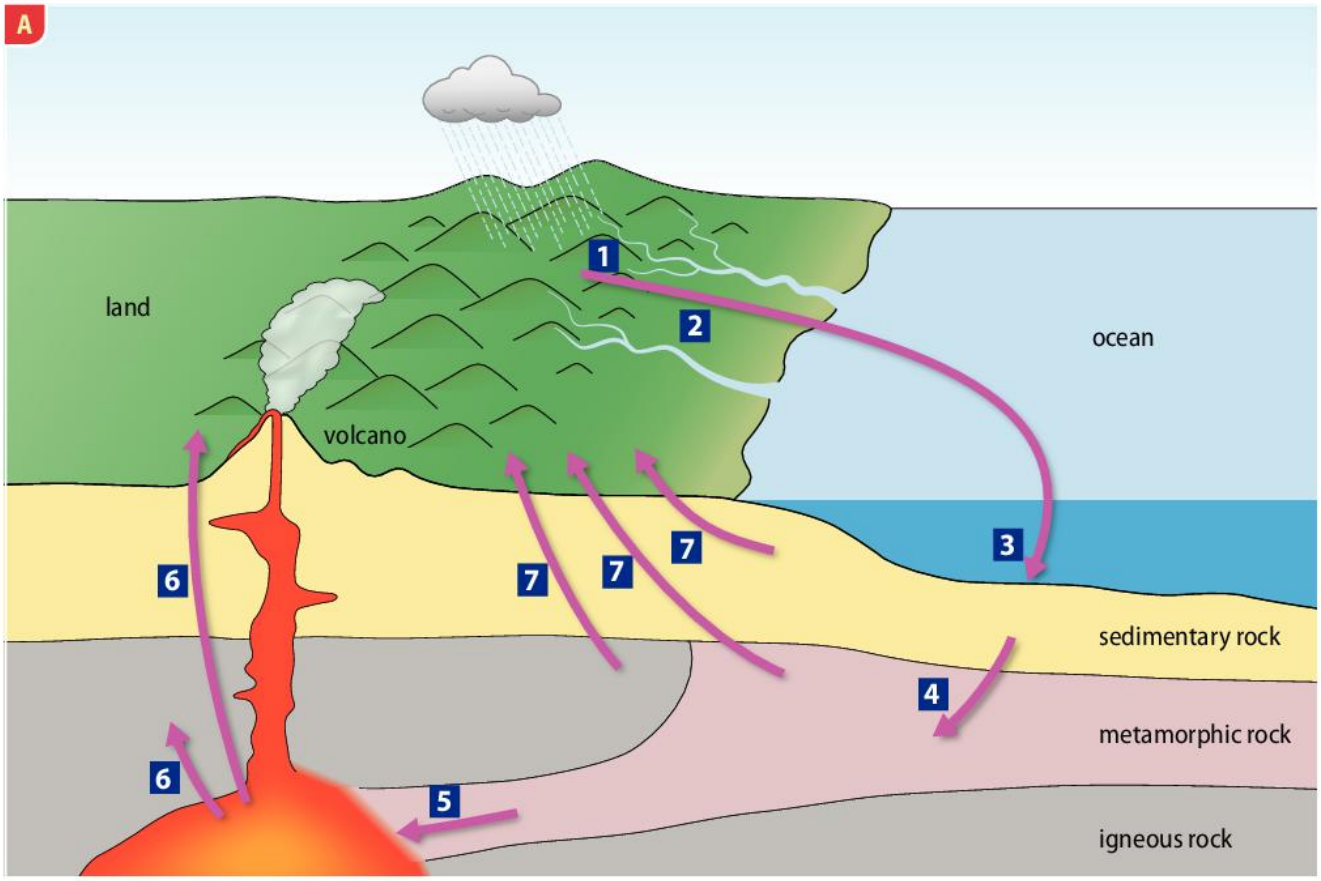
1. The set of processes which break down rock is called *weathering*. Why do you think that name was chosen?
2. Page 10 shows four kinds of physical weathering. Choose *one*, and draw diagrams to show how this process breaks rock into bits.
3. What's the *key difference* between physical and chemical weathering?
4. Over time, flat areas of limestone begin to look like big rough pavements, with lots of gaps. Suggest a reason.
5. How is clay formed?
6. One kind of weathering shown on page 10 is sometimes called *biological* weathering. Which one?
7. *The weathering of rock benefits humans.* See how many examples you can give, to support the statement in italics.

1.4 The rock cycle

Sedimentary rock may change into metamorphic rock, or igneous rock … and then back to sedimentary rock. How ? Find out here.

All change

Rock is changing all the time, from one type to another. It's called the **rock cycle**. This is how it works …



1. Rock at Earth's surface is broken down to stones and sand and clay by **weathering**.
2. The river **erodes** (picks up) the stones and sand and clay, and **transports** them away.
3. As it enters the ocean it **deposits** (drops) its load. A thick layer of sediment builds up on the ocean floor. It is compacted to form **sedimentary rock**.
4. Sedimentary rock gets forced down into Earth's crust. The heat and pressure change it to **metamorphic rock**.
5. The metamorphic rock may be buried further … and it gets so hot that it melts. The liquid rock is called **magma**.
6. The magma cools to form **igneous rock**. Some cools below Earth's surface. Some shoots out at volcanoes as lava, and cools at the surface.
7. Rock is raised *upwards* too. Sedimentary rock on the ocean floor gets lifted up to form land. Igneous and metamorphic rock also get uplifted. When these rocks reach the surface, the cycle starts all over again !

▲ *David, sculpted from marble by Michelangelo. Marble is the metamorphic rock obtained from limestone. So David was once sea shells !*

An example of the cycle in action

Let's begin with something you know well: sand!

B

particles of a mineral

Sand is mainly **quartz**. It forms when granite and other rocks that contain quartz are broken down by weathering.

sedimentary rock

Over time, a sediment of sand on the ocean floor turns into **sandstone**. On exposure to high pressure and /or heat …

metamorphic rock

… the sandstone will become **quartzite**. If this gets hot enough it will melt, and get mixed with minerals …

igneous rock

… from other rocks. The magma may harden underground, to give **granite**, containing quartz crystals.

The granite may get pushed upwards. Or the rock above it may get eroded away. So it eventually reaches the surface …

… where it gets weathered. The quartz crystals are released as sand. And the cycle starts again.

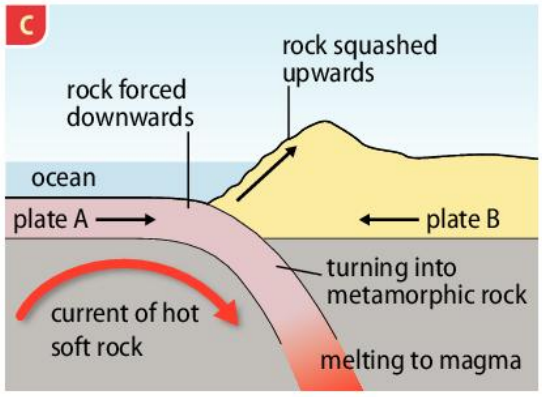
What pushes the rock?

As you saw on page 12, rock gets pushed down into Earth's crust (step 4 of the rock cycle), *and* raised upwards (step 7). What causes this?

- First, you need to know that the hard outer part of Earth is cracked into huge slabs. We call these slabs **plates**.
- Below the plates, it's so hot that the rock is partly melted. It is like soft toffee. Currents of hot soft rock flow around, very very slowly.
- These powerful currents drag the plates along. As they move, some plates collide. Then rock is forced down between them (step 4) or pushed upwards (step 7). Look at diagram **C**.

So it is really the plate movements which drive the rock cycle. You will learn more about them, and plates, in Chapter 5.

C



▲ *Plates get dragged around, and may push into each other. Where their edges meet, as above, the heavier one sinks. That's how sedimentary rock gets buried.*

Your turn

First, do a simple sketch of the rock cycle. On your sketch …
- show labels for the three types of rock
- mark in the arrows (but without numbers)
- add these four labels to the arrows where you think they should go:
  burial *melting* *uplift* *erosion and transportation*
- and finally, insert these labels: *magma* *weathering*

2 Panel **B** at the top of this page shows how sand becomes granite, which then releases sand on weathering. Suggest how *quartzite* could become *sand*, without melting.

3 a What are *plates*, in geography?
b Plates are always on the move. Why?
c Explain how plate movements cause sedimentary rock to get buried.

1.5 The British Isles on their travels

The land you are living on once lay at the Equator.
How did this happen? Find out here.

A long long journey

Earth's continents are very different today than they were a billion years ago. Different sizes, and shapes, and positions.

Why? Because the continents are moving! They – and the oceans – are carried on the **plates** you met in Unit 1.4. As the plates move around they may break up, or join to other plates. So the continents and oceans change too.

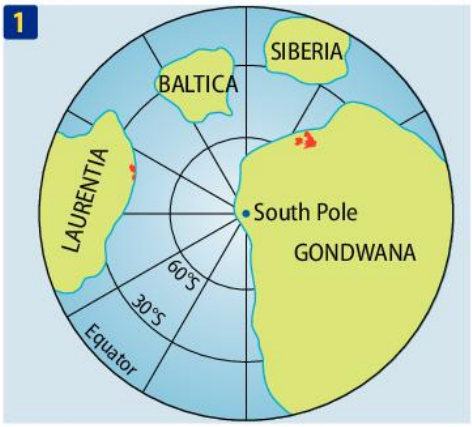
Did you know?

- The plate you live on is moving eastwards at about 1 cm a year.

From 550 million years ago

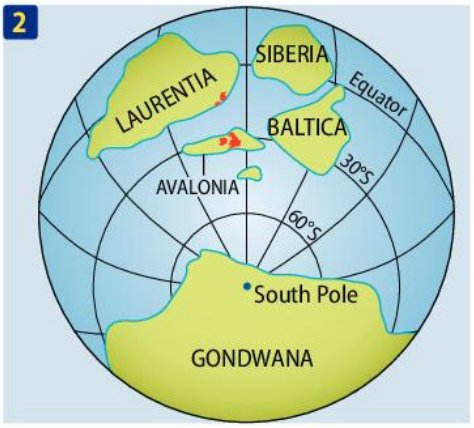
Let's start from 550 million years ago (550 mya), to see how the continents have changed. Look at their names. And look out for the land that is shown in red. It's the land that forms the British Isles today!

1



550 mya. The land that will become the British Isles is in two places, far apart. Most is quite far south, in Gondwana. The rest is in Laurentia.

2

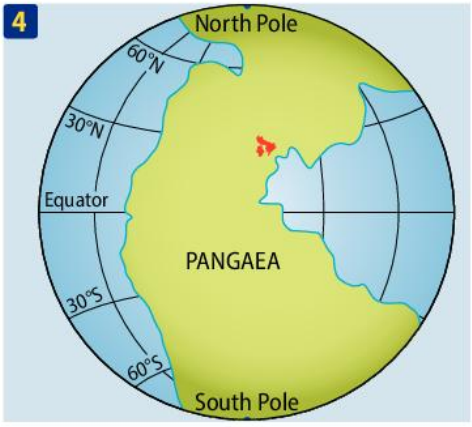


450 mya. A mini continent, Avalonia, broke away from Gondwana some time ago, and is now heading north. Look where the red patches are.

3

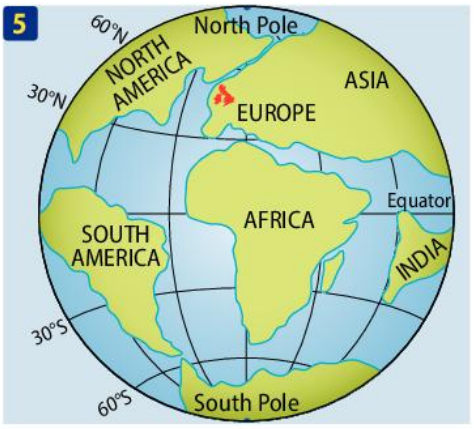
395 mya. Avalonia and Baltica have collided with Laurentia. The land that will form the British Isles is together at last, near the tropics.

4



300 mya. Now all of Earth's land has joined to make a super-continent, **Pangaea**. And look: our land has crossed the Equator.

5



65 mya. Pangaea lasted for about 100 million years. Then it broke up to form new continents. Here they are, 65 mya. Do any look familiar?

6

Today. The continents as they are now. They are still moving, very slowly. So if you come back in say 100 million years, the globe will look different.

What about living things?

What kind of life did the continents carry, as they moved and changed?

The **geological timescale** on the right will help us answer that question. (You met it in *geog.1*.)

It shows that 550 mya, Earth was in the **Precambrian eon**. There were sponges and other simple soft-bodied animals. But nothing with shells or bones yet, and no life on land.

By 450 mya, land plants had appeared. By 237 mya, there were dinosaurs and lush forests on Pangaea.

By 65 mya, the continents were looking more like today's. And the age of mammals had begun. But no sign of us yet! The first human species did not appear until 2.6 mya.

Fossils in the UK

As it travelled, the land that's now the UK was sometimes under ice, and sometimes under warm shallow seas. Sometimes it was desert. At each stage, it was home to different species.

That's why the UK has so many fossils from faraway places. They are evidence of its long long journey.

▲ *A footprint of a reptile, found in Cheshire, UK. This trace fossil, preserved in sandstone, is about 220 million years old.*

The geological timescale

Era	Period	How long ago?
	THE PHANEROZOIC EON (OURS)	
		today
Cenozoic (recent life)	**Quaternary** we (*Homo sapiens*) appear and spread	
		2.6 mya
	Neogene apes, chimpanzees, rhinos, horses, sheep …	
		23 mya
	Paleogene mammals and birds flourish	
		66 mya
Mesozoic (middle life)	**Cretaceous** dinosaurs rule; period ends with their extinction	
		145 mya
	Jurassic more dinosaurs appear; first birds	
		200 mya
	Triassic first dinosaurs and mammals	
		250 mya
Paleozoic (ancient life)	**Permian** first conifer trees; warm-blooded reptiles	
		290 mya
	Carboniferous on land: lush forests, reptiles, giant insects	
		300 mya
	Devonian first animals on land	
		420 mya
	Silurian first bony fish; more land plants	
		445 mya
	Ordovician first land plants	
		485 mya
	Cambrian first animals with shells appear in the sea	
		540 mya
	THE PRECAMBRIAN EON first soft-bodied animals appear in the sea	600 mya
	first living cells appear in the sea	3.5 bya
	Earth is formed	4.5 bya

Your turn

1 Name three of the continents that existed 550 mya.

2 Those continents from 550 mya no longer exist today. Why not? Explain in just 30 words.

3 By 395 mya, the land that now forms the British Isles had come together.
- a What geological period was this in?
- b Were there any giant insects on land by then?

4 Look at the photo of the reptile footprint, above.
- a In which geological period did this reptile live?
- b Name the continent(s) which existed when it was alive.
- c i See if you can suggest *how* this footprint got preserved.
- ii Explain how it ended up far from where it was made.

5 Many dinosaur fossils have been found in the UK. But none are *less than* 65 million years old. See if you can explain why.

1.6 Rock around the UK

Why has the UK got so many mountains? And so many different kinds of rock? Find out here.

A

▲ *Pettico Wick in Scotland (at ● on image B). The rock shows signs of the pressure it came under, when continents collided.*

How the British Isles got their mountains

Below is a satellite image of the British Isles. (We removed the sea.)

Look at all those mountains. They formed when the land was at or near plate edges, and plates pushed into each other. So rock piled up.

B

1 These mountains formed 425 – 395 mya, when plate movements brought Baltica, Avalonia, and Laurentia together. (Look at globe **3** on page 14.)

2 For example, this range marks where Avalonia collided with Laurentia, about 395 mya. That's when England and Scotland joined!

3 These formed later, about 300 mya, when continents joined to form Pangaea. (Globe **4** on page 14.)

Key
- mountains
- low flat land

So the mountains are like a book that tells the story of the British Isles' travels.

Today, these islands are a long way from plate edges. So no more mountains are being built. Instead, our mountains are being weathered and eroded.

A closer look at the UK's rock

There's soil and clay and stones over most of the UK. But if you shovel them away you'll reach solid rock or **bedrock**.

Map **D** shows the UK's bedrock. Most of it is sedimentary rock. Look at the key.

But remember: below the sedimentary rock is metamorphic and igneous rock. (Check the last diagram on page 9.)

All kinds of sediment

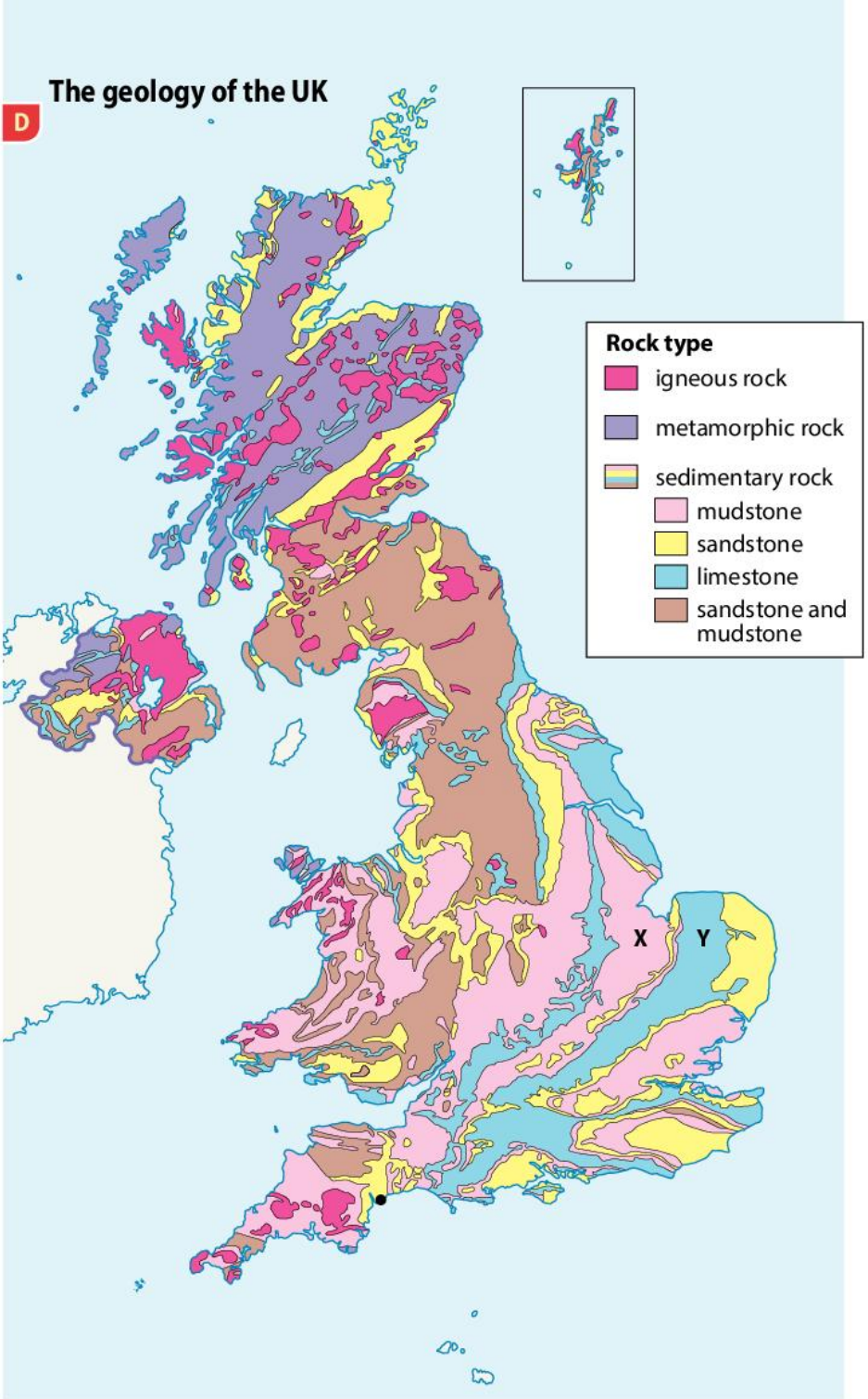
As it moved around, the land that is now the UK gathered sediment in many different environments, over millions of years.

So we have a range of sedimentary rock of different ages – with different fossils too!

C

▲ *Red sandstone at Ladram Bay in Devon (at ● on map D). It formed over 200 mya, when Britain was in Pangaea, and much closer to the Equator.*

D



Your turn

1. Why does the UK have so many mountains?
2. Find the yellow dot ○ on image **B**. It's in the mountains.
   - a What are those mountains called? (Page 139.)
   - b To which rock group do they mostly belong?
   - c Scotland has lots of this rock. See if you can explain why.
3. Photo **A** shows Pettico Wick, on the east coast of Scotland. What evidence can you see that the rock here was under great pressure, when continents collided?
4. Look at map **D**. Which type of bedrock does the UK have most of: igneous, metamorphic, or sedimentary?
5. Find **X** and **Y** on map **D**. The rock at **X** formed in the Jurassic period. The rock at **Y** is from the Cretaceous period.
   - a Name the types of sedimentary rock at **X** and **Y**.
   - b Where is the rock older – at **X** or at **Y**? (Page 15?)
   - c Which do you think weathers more easily – the rock at **X**, or the rock at **Y**? Explain your choice. (Image **B**?)

1.7 Rock and landscapes

Here you'll explore how landscape varies with rock type.

Different rocks, different landscapes

The UK has a big variety of landscapes – because it has a big range of rocks.

Landscape varies with rock type. That's mainly because different rocks weather in different ways, and at different rates. Let's look at three examples.

◀ *The dots show where photos A – D below were taken.*

Granite – an igneous rock

Granite is resistant to weathering. It breaks down very slowly to sand and clay and stones. It's also **impermeable**: it does not let water soak through.

So where there is granite, you can expect to find:

- land that's higher than the surrounding areas
- thin soil
- boggy areas, because rain can't soak away easily
- sheep farming, since the soil is not good for crops.

A

▲ *Dartmoor, in Devon, has the largest area of granite in the UK. This outcrop of rock is called a **tor**. A tor forms when some granite weathers more slowly that the rest. This one is named High Willhays. In the distance is Yes Tor.*

Limestone – a sedimentary rock

As you saw on page 11, rain is slightly acidic. So it reacts with limestone, which is mainly calcium carbonate.

- The rain soaks down between blocks of limestone, dissolving the rock as it goes.
- **Potholes** and **underground caves** form.
- Streams may disappear down **sinkholes** in the limestone, and then emerge somewhere else.
- Since the limestone dissolves, the soil in limestone areas is thin and poor. So it is often used for sheep farming.

▼ *A limestone landscape in the Peak District.*

B

▼ *This limestone feature is called a **pavement**.*

C

Mudstone – a sedimentary rock

Mudstone weathers quickly, to produce clay.

- So you get low flat land, and thick soil.
- Clay swells when it gets wet, and this stops further water soaking through it. So you'll find many ponds and streams.
- Clay is full of the nutrients that plants need. So you'll find plenty of crops being grown, where the rock is mudstone.

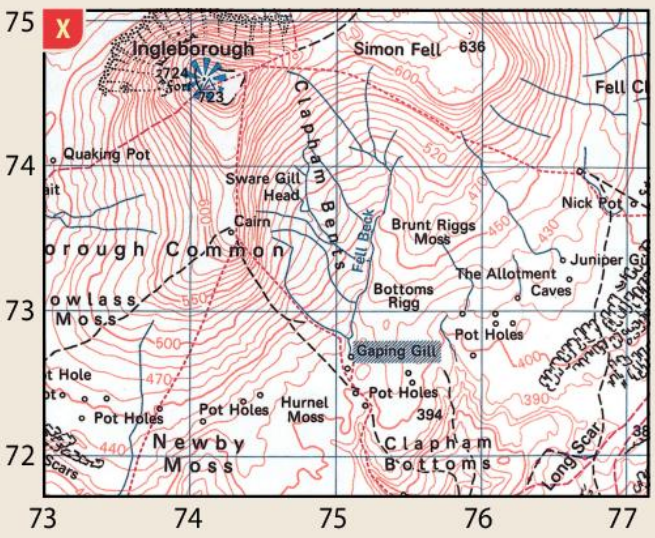
Did you know?

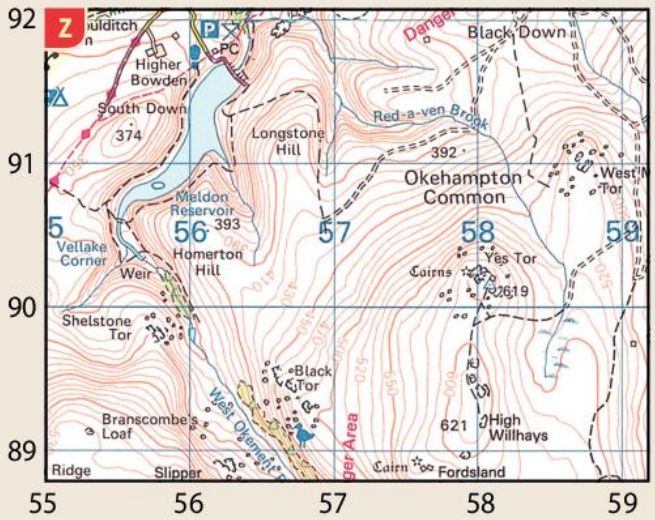
- Because it weathers and erodes easily, cliffs made of mudstone are at risk of collapse.

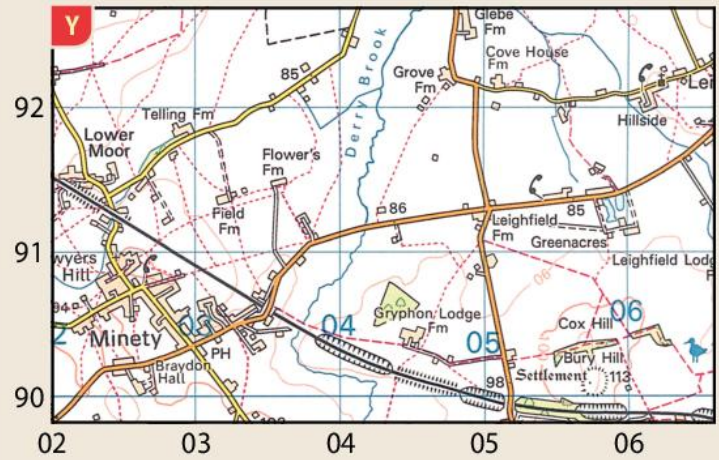
▶ *Farmland in Wiltshire, in an area where the bedrock is mudstone.*

Your turn

1. In photo **A** the rock is granite. In photo **B** it's limestone.
   - a What similarities can you see (if any) in these landscapes?
   - b What differences (if any) do you notice?
2. Now compare photos **B** and **D.**
   - a List the differences you notice in these two landscapes.
   - b What is the main reason for these differences?
3. Photo **C** shows a *limestone pavement*. See if you can explain how it was formed. (Try page 11 if you get stuck!)
4. Now put the three rock types in order of their resistance to weathering, with the most resistant first. The text will help.
5. Look at the OS map extracts **X**, **Y** and **Z**. They are for granite, limestone, and mudstone areas.
   - a First, match each OS extract to the correct rock type, using what you have learned about the rocks.
   - b For each match, give your evidence from the OS map.







Scale for OS maps 1:50 000

1.8 Soil … and you

Over time, rock breaks down to give soil. What exactly is soil? And why is it really important? Find out here.

What is soil?

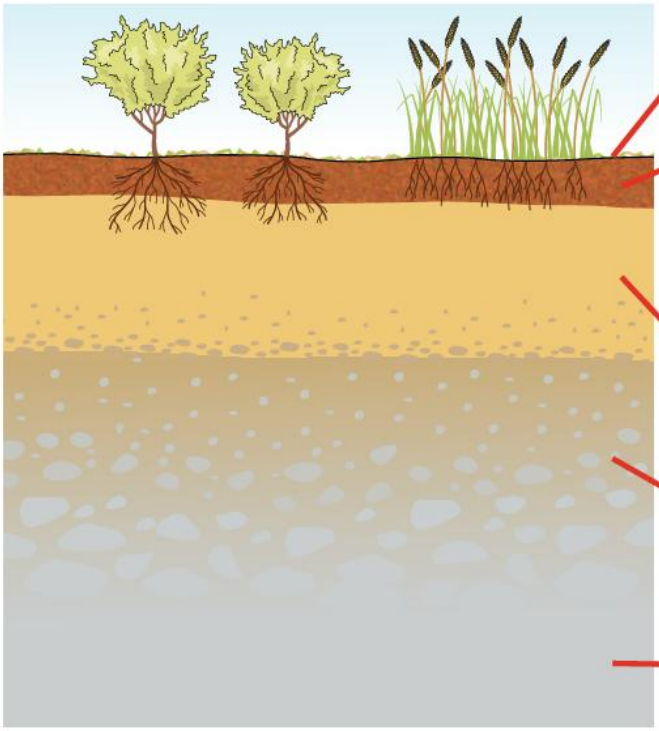
Soil is a mixture of clay and sand and rotting vegetation. The clay and sand form when rock is broken down by chemical weathering. (See page 11.)

Did you know?

- Many of the antibiotics we use were first found in soil.
- For example, penicillin is made by a fungus in soil.

The soil profile

If you sliced down through soil, you'd see these layers:



humus. It is a thin layer of rotting vegetation – such as grass and leaves. The **nutrients** in it return to the soil.

topsoil. This layer is rich in humus, and the minerals from the rock. So it is good for growing crops..

The plants take in nutrients such as potassium, phosphorus, calcium, and silicon, which came from the rock – as well as nitrogen, which bacteria in the soil 'fix' from the air.

The sand helps to make clay more crumbly. That's good for roots.

subsoil. It has little humus, but it's rich in minerals. Tree roots reach this layer.

rock that is being weathered. It has been broken into chunks already. There are few signs of life this far down.

bedrock. Solid rock, not yet weathered. It will be, one day.

Secret life

Soil may look dead. But it teems with life: bacteria, fungi, and insects and other animals. It's the most biodiverse environment on Earth!

For example, a teaspoon of soil may contain up to a billion bacteria of different types. Many feed on dead plant material, 'rotting' it to humus.

Earthworms help soil a lot. They digest leaves and clay, so their waste is rich in nutrients. And the tunnels they bore help air and water to circulate easily.

▶ *Your best friend?*

Soil and you

You may think soil is dirty, and boring, and nothing to do with you.
It's time to think again!

Let's start with the parent rock. Its minerals may contain atoms of many different elements.

When the rock is broken down by weathering, and soil forms, the soil also contains those elements.

Plants need many of the elements. They take them in through their roots, along with nitrogen and water.

They use them, with carbon dioxide from the air, to make their food. Then animals eat the plants for food.

You eat plants too – and probably animals, and dairy products. That's how elements from rock reach you.

You use them to build up your bones and flesh and teeth and hair and blood. You'd *die* without them.

Looking after soil

There are more than 7 billion humans on Earth, and we depend on the soil for our survival.

Each crop removes nutrients from the soil. So, after many crops, soil may be low in nutrients. Then crops won't grow well. In the end, the soil may be useless.

That is why farmers add **fertilisers** to soil. These may be artificial fertilisers, made in factories. Or natural fertilisers such as animal manure.

In many places around the world, the soil is already useless. So crops fail, and people may suffer malnutrition. Find out more in Unit 2.5.

▲ *Spreading a slurry of animal manure on the land. It adds nutrients to the soil.*

Your turn

1 a What is soil?
  b Where does it come from?
  c It contains nutrients that plants need. What are *nutrients*? (Glossary?)
2 In what way does humus help soil?
3 Which layer of soil is the main one, for growing crops?
4 a Explain how soil may become useless.
  b Fertilisers restore nutrients to soil. What are *fertilisers*? See if you can explain without using the glossary.
5 Do you think we could run out of soil one day? Explain.

2 Living off Earth's resources

The big picture

This chapter is about **natural resources** – things which occur naturally on Earth, and which we make use of. Here's the big picture …

- We all have basic needs which must be met. For example we need food, and water, and a source of energy (to heat things).
- We rely on Earth's natural resources to meet those needs.
- The human population is growing fast – and our demands are growing too. So every year, we use more and more of Earth's resources.
- As our demand for resources grows, we drive out other species.

Did you know?
- The world uses about 14 billion litres of oil (petroleum) a day.

Why…
- … do we use so much oil?

Your goals for this chapter

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

- Explain these terms, and give two examples for each.
  natural resource *renewable resource* *non-renewable resource*
- What do these terms mean?
  fresh water *groundwater* *aquifer* *irrigate*
  physical water scarcity *economic water scarcity*
- What is the main use of fresh water, around the world?
- More and more people face the problem of water scarcity. Give three examples of things that could be done, to tackle the problem.
- What and where are: Earth's drylands? the Sahel?
- Explain why desertification is a major world problem.
- Name five countries which have large reserves of oil.
- Many countries are trying to use less oil. What's the main reason?
- Name five natural, renewable resources used to produce electricity in the UK.
- Solar power can make a big difference in poorer countries. Explain why.
- Many species are at risk of extinction – and we are the cause. Explain why.

Did you know?
- There are plans to capture an asteroid …
- … and mine it for precious metals, like gold.

Did you know?
- There's over 100 times more water below ground than in rivers and lakes.

What if…
- … aliens stole all our underground water?

Why…
- … don't we just drink seawater?

And then …

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

Your chapter starter

Look at the photo on page 22. What is she doing?

That brown stuff is really important to humans. Why?

Where did it come from?

Do you think it is found everywhere?

Could we run out of it? Why do you think that?

2.1 Earth's natural resources

We depend on Earth's natural resources. But what are they? And where? And are there enough? Find out more here!

Did you know?

- We have used up more copper in the last 25 years than in the previous 10 000.

Meeting our needs

Every day, we humans depend on Earth's natural resources.

We arrive on Earth with nothing. Not even clothing. And very soon, we start to rely on Earth for our needs.

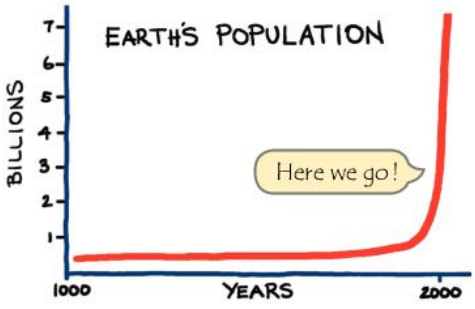
We have five basic needs which must be met, if we are to survive. They are given above.

Our early ancestors made use of the natural resources they found around them, to meet these needs.

About 12 000 years ago we learned how to farm. From then on, soil was an important resource for us.

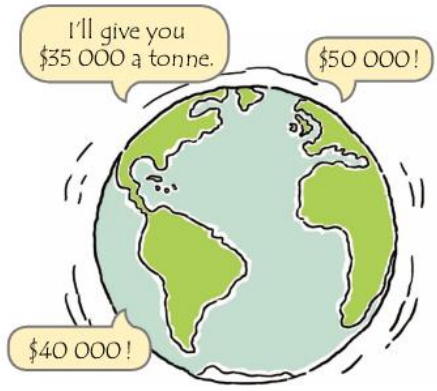
As time went by, we found more and more ways to use what Earth provides: things like metals, and gas, and oil.

Today, we still have the same basic *needs* as our ancestors. There are also lots of things we *want*.



And there's one huge challenge. Our population keeps rising. It has more than doubled in the last 50 years.

So we are using more and more of what Earth provides. But the supply of most natural resources is limited!



We are already competing for some of them. Some may even run out. What will we do then?

So what *are* natural resources?

A natural resource is something which occurs naturally – without any help from us – and which we can make use of. Like soil, water, wind, sunlight, coal, oil.

We use a lot of plastic too. But it is *not* a natural resource. We make it in factories.

Some are renewable

A **renewable** resource is one which we can keep on using, and it won't run out. For example we need sunlight for growing crops – and the sun shines on Earth every day. It won't run out. (Or at least not for another 5 billion years.)

But oil is a **non-renewable** resource. It takes millions of years to form. We are using it up much faster than it is forming. So one day we may find that there's hardly any left.

Where are the natural resources?

Natural resources are found everywhere. But they are not shared equally!

For example, all countries get rain – but some get very little, and others get lots. And all countries get sunlight, but it is stronger in some than in others.

Our early ancestors made do with the resources around them. But not us! We use resources from all over the world. When you eat an orange, you are making use of the soil and water and sunshine in Spain, or Brazil, or California.

That big challenge

We humans face a huge challenge: a rising population, and limited natural resources.

In the rest of this chapter we will look at two natural resources you can't live without – water, and soil. As the population rises, will there be enough for everyone? We'll also look at oil, and renewable resources for energy.

Did you know?

- Our Sun will die in about 5 billion years, when it runs out of hydrogen.
- Long before then it will give out so much heat that Earth's oceans will boil away.

Did you know?

- Even the air is not shared equally.
- The higher the land, the thinner the air.

Did you know?

- You could live for over 3 weeks without food (you'd feel awful)...
- ... but not much more than 3 days without water.

Your turn

1 What is *a natural resource*?

2 Think about each item **A** – **H** listed below.
   - **a** Is it a natural resource? Decide *yes* or *no*, and explain.
   - **b** If your answer is *yes*, give an example of how we use it.

   A air **B** paper
   C rock **D** rain
   E the ocean **F** glass
   G rainforest **H** chocolate

3 What is:
   a a *renewable* resource? **b** a *non-renewable* resource?
   Check the glossary if you need to.

4 Is this natural resource renewable, or non-renewable? Explain your answer.
   a wind **b** coal **c** gold **d** rain

5 To survive, you need food, water, clothing, shelter, and a source of heat energy (to warm yourself, and / or cook food). Now imagine you were on a ship in the Pacific Ocean. There was a storm. You got shipwrecked. And here you are, alone, on a small island. A bag came ashore too. In it are two glass bottles, a big sharp knife, and a reel of strong wire.
   a Describe your island.
   b Now say how you'll meet those five basic needs!

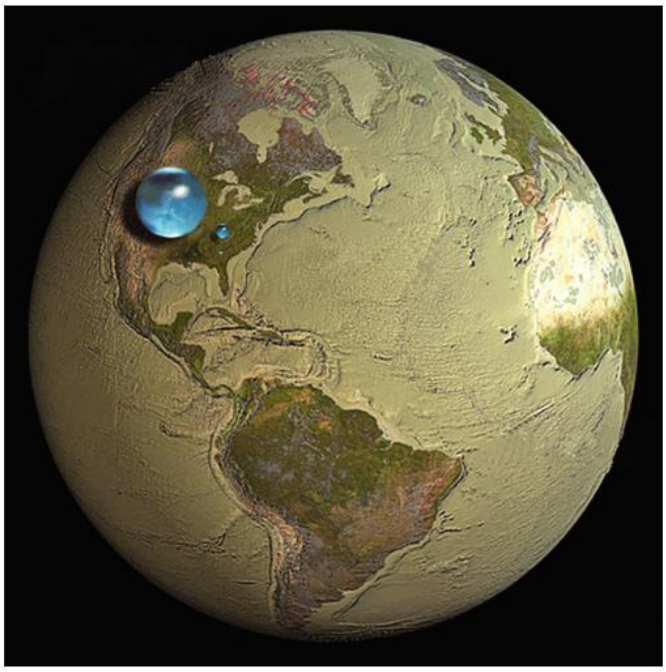
2.2 Water around the world

Already, today, you have used an amazing natural resource: water. Is there enough of it? Find out here.

There's a lot of water around

We can't live without water. And Earth seems to have a lot of it. But … we can't use most of it!

- 97% of Earth's water is in the oceans – and it is **salty**. So you must not drink it. Your kidneys would fail. You'd die.
- 3% of Earth's water is **fresh** (not salty). But over two-thirds of this is not available. It's frozen into ice sheets and glaciers.
- Less than 1% of Earth's water is fresh water we *can* use. But most of this is *below ground*, as **groundwater**. So first we have to find it – and then pump it up.
- The fresh water at the surface, in rivers and lakes and swamps, is only a tiny portion of Earth's total water: **0.01%**.



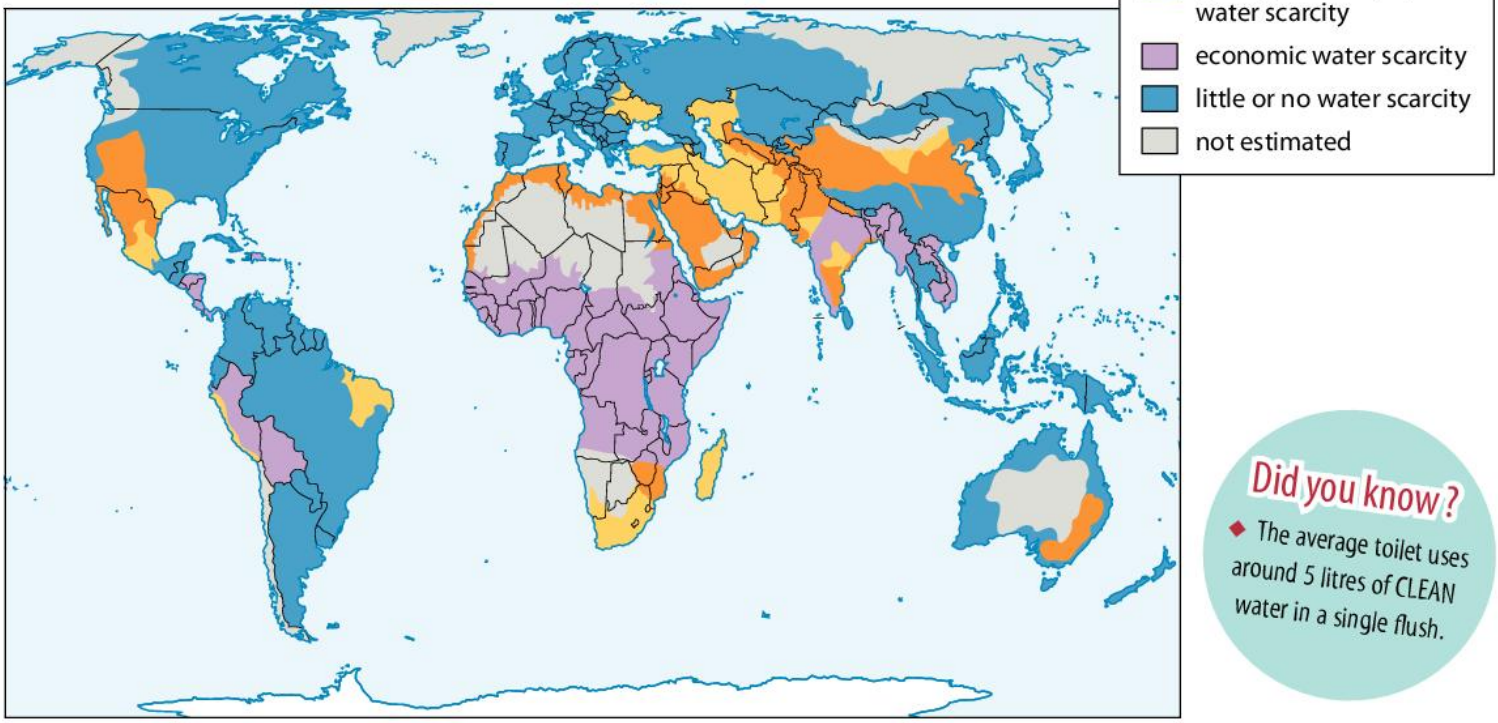
▲ *Look at the three blue spheres. The biggest represents the total volume of water on Earth. The next: the total volume of liquid fresh water. The tiny one: the volume of liquid fresh water at Earth's surface.*

Fresh water: not shared equally

Fresh water is not shared equally. It is scarce in places. Look at the map below.

Some areas have **physical water scarcity**. There just isn't enough water to meet everyone's needs. Low rainfall, and a large population, are big factors. But **overuse** may be a factor too. For example, farmers may use too much.

Other areas have enough water – but people can't access it because of **poverty**. These areas can't afford the **infrastructure** – pumps, pipes, and so on – to bring clean fresh water to everyone. This is called **economic water scarcity**.



Did you know?

- The average toilet uses around 5 litres of CLEAN water in a single flush.

What do we use fresh water for?

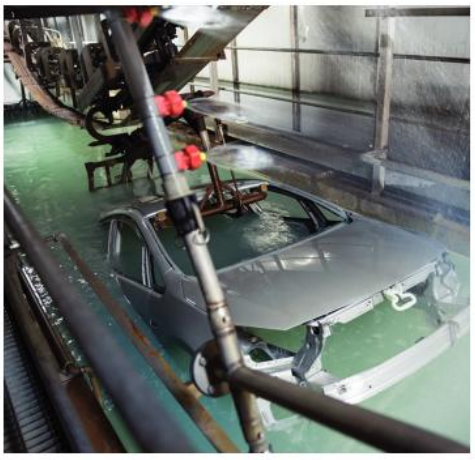
Every year, we humans withdraw a huge amount of fresh water from rivers, and lakes, and below ground: about 4000 km^3.
(Imagine a cube of water with sides 1 km long. Then imagine 4000 of them!)

What do we use it for? Look:

What if...

◆ ... you were allowed only one shower a week?

The biggest share (about 70 %) goes to farming, mainly to **irrigate** crops. Plants take in water through their roots. (The rest soaks away, wasted.)



About 19% is used in industry. It is used in factories to dissolve things, and wash things. In power stations it's turned into steam to spin turbines.

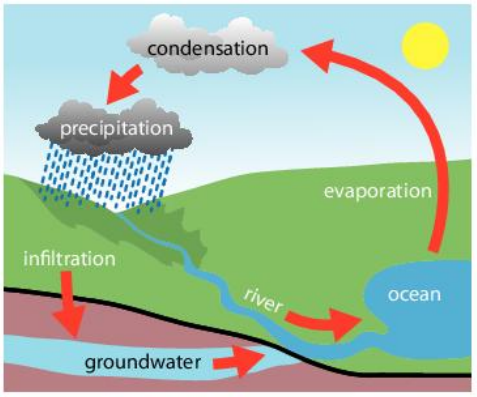
The rest (11%) is for our domestic use: drinking, cooking, washing, flushing the toilet. Only a small % of it is used for drinking.

A renewable resource?

So is fresh water a renewable resource? Yes, in theory.

Remember the **water cycle**. Water is evaporated from the ocean, leaving the salt behind. It falls as rain. This runs into rivers, or soaks into the ground as groundwater, which feeds rivers. The rivers carry the water back to the ocean … and the cycle begins again.

But in many places, we are using fresh water faster than the water cycle can replace it. And then it's *not* a renewable resource. The next unit has an example.



Your turn

1 **Salt water** from the ocean gets turned into **fresh water**, which we humans can use. Explain how this happens.

2 What does this term mean?
a physical water scarcity b economic water scarcity

3 Name the *continent* with the biggest area of:
a economic water scarcity b physical water scarcity

4 Using page 141 to help you, name two countries in Asia with:
a little or no water scarcity b some economic water scarcity

5 Which kind of water scarcity do you think is easier to tackle: economic, or physical? Explain your choice.

6 Look at this pie chart. The slices have no labels! Using the information on this page, suggest a label for:
a the red slice
b the blue slice
c the green slice

7 Imagine this. It stopped raining in the UK five months ago – and hasn't rained since. How are people coping? How has the UK changed? Write a radio report. (With interviews?)

2.3 What have they done to the Ogallala?

This is about one area where fresh water is not a renewable resource. It's in the Great Plains in the USA.

The end of the good days?

Doug is 85 today. He looks out over the farm. The sprinkler is sprinkling. The corn is growing. He should be happy. But he's not.

He thinks back over his life. Things were so different in Kansas when he was a boy. Farming was tough. Droughts were common. Soil dried up. Crops failed. He still remembers the dust storms. It was hard to survive.

Then came World War II. After it ended, the good days began. You could buy motor-driven pumps, to pump water from the Ogallala. Endless water. Drought was no longer a problem. His father bought more and more land. They grew wheat and corn and soybean.

Now Brad, his son, runs the farm. He wants Brad and the kids to have a good life. But he is worried. The good days may be coming to an end … because the Ogallala is running out of water.

What is the Ogallala?

The Ogallala is one of the world's largest **aquifers**. It lies beneath the Great Plains, the region which runs from Canada down the middle of the USA. Eight states share the aquifer. Look at maps **A** and **B**.

Most of the water in the Ogallala is at least 8000 years old. So it's called **fossil water**. It has been trapped there since the last ice age.

A

▲ *The Ogallala aquifer lies below the Great Plains, which extend all the way into Canada.*

B

▲ *The states which share the Ogallala.*

C

▲ *Where Doug and Brad live. The green circles are crops. Giant arms rotate like a clock hand, sprinkling the crops with water from the Ogallala. Look how long the sprinkler arms are, compared with the buildings.*

D

▲ *In the USA in the 1930s, the Great Plains were called the Dustbowl. Droughts were frequent. Fierce winds whipped dust from the dry soil. Dust storms even reached New York.*

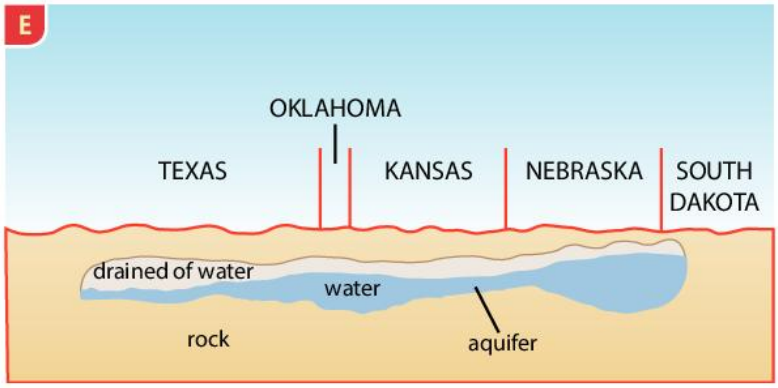
And the problem is … ?

There is not much rain in the Ogallala area. So there's not much water trickling down into the aquifer.

But thousands of litres are pumped *out of it* each day. In Kansas alone, 39 000 pumps suck water from it.

So it is no surprise that the water level is falling. In places it has dropped more than 30 metres since pumping began.

This means farmers must drill deeper and deeper, and use more powerful pumps, to get at the water. But these just make the problem worse.



▲ *A simplified cross-section through the Ogallala. The aquifer is deepest under Nebraska – so farmers there can rely in it for longer.*

What can be done ?

Some places have about 20 more years of water from the Ogallala, at present pumping rates. Then it's back to relying on the uncertain rain.

Farmers could limit how much they pump, to make the water last longer. Some are happy to do this. Some are not. But even if they all stop pumping right now, it will take hundreds of years for the aquifer to refill.

What will the future bring ?

Many parts of the Ogallala will run dry. Then, with only rain to water crops, and with frequent drought, many farms will fail. Farming communities will be devastated. Towns will be deserted.

People far beyond the Ogallala will feel the effect. Thanks to the aquifer, the area became the **breadbasket** of the USA. It provides a large share of the wheat and other grain crops used in the USA, and for export.

Without the Ogallala, what will they do ?

▲ *Without the water from the Ogallala, farmers must cope with frequent drought.*

Your turn

1 a What is an *aquifer* ? (Glossary ?)
b Where is the Ogallala aquifer ? (Continent and country !)
c Name four states which share the Ogallala aquifer.

2 Look at photo **D**. What are those dark clouds made of ? And why did they form ?

3 Look at photo **C**.
a Why are there big green circles, in a brownish landscape ?
b What differences might you expect to see, if you were to visit this place in 50 years' time ?

4 Many groups of people will be affected when the Ogallala can no longer provide water. See how many you can think of. (The farmers ? Shoppers ? People in other countries ? The government ?) You could show your answer as a spider diagram.

5 The water level in the Ogallala is falling really fast below Texas. Look what this Texan farmer has to say:

Do you think this piece of Texan law is fair ? Give your reasons.

2.4 The growing water challenge

The human population is rising. Everyone wants more water. What can we do? Find out more here.

Help! We need more water!

Our demand for fresh water is growing every year.

The main reason is the rise in Earth's population. It is growing by over 80 million people a year. And each person must have water.

Also, as countries develop, people eat more meat. It takes about 2500 litres of water to produce 1 kg of rice – and six times as much for 1 kg of beef!

As countries develop, people want more goods too. Washing machines, cars, mobiles. Industry uses more and more water to produce them.

So … we have a dilemma

- The demand for water is rising.
- Already, many areas don't have enough water.
- And climates are changing. Some parts of the world will have more rain – but some will have less.

Experts say that by 2025 – which is not far off – half the world's population will face water scarcity. Finding water for them will be a big challenge. Let's look at what we can do to meet it.

Tackling economic water scarcity

As you saw on page 26, economic water scarcity is linked to poverty.

- About 1 in 8 of us does not have access to a clean safe supply of water. That's around 900 million people.
- They live in countries which can't afford to pipe clean safe water to everyone. So people collect dirty water from rivers and ponds. It may be infected, and cause disease.
- Usually, it's up to women and girls to collect water. They may have to walk miles to the river. It can take hours, several times a week. The buckets and basins full of water are heavy to carry.
- A clean, safe, water supply would transform the lives of these people.
- Many poorer countries are now making water supply a priority.

▲ *Economic water scarcity.*

Tackling physical water scarcity

Physical water scarcity means an area does not have enough water for everyone. How can we tackle this?

1 Use water more wisely

As you saw in Unit 2.2, agriculture is the biggest user of water.

- Water crops only when they need it. For example, sensors can monitor leaf temperature, and turn sprinklers on when a certain temperature is reached. (Look at the photo on the right.)
- Grow crops that need less water. Corn is a very thirsty crop. Potatoes need a lot less water.

We can save water at home too. For example …

- Use less water in the shower, and bath, and kettle, and washing machine.
- Recycle water. Use **grey water** – from baths and showers and sinks – to flush toilets, and water gardens.

2 Bring in water from other places

- For example, China has a massive project to move water over 1000 km from the Yangtze river to the dry north of China.

3 Use salt water

- The salt water from the ocean will kill you – and kill crops. But it can be treated to remove the salt. For example, you can evaporate it to leave the salt behind, and then condense the water vapour.

  The process of removing salt is called **desalination**. It needs a lot of electricity. So it is most widely used in the countries of the Arabian Peninsula (page 132), which have coastlines, plenty of cheap oil or gas for generating electricity, and not much rain.
- Develop crops which can tolerate salt water. (There is plenty of that!) People are already working on this. Look at the example on the right.

▲ *Fitting sensors to sprinklers in Texas, to help the Ogallala. They measure leaf temperature, and tell the sprinklers when to turn on.*

▲ *A new channel carrying water from the Yangtze to northern China.*

▶ *In the Netherlands, they've developed a potato plant you can water with salt water. Salty chips, anyone?*

Your turn

1 The main reason the world faces a shortage of fresh water is … ?

2 See if you can explain why it takes six times as much water to produce 1 kg of beef as 1 kg of rice.

3 Look what this person suggests. Is it a good idea? Explain your answer.

4 You are making a new resolution: to save water. Make a drawing to show four things you will do. (No silly suggestions!)

5 a What is *desalination*?
b Do you think we might ever run out of salt water? Give your reasons.

6 Now, using the maps on pages 26 and 140 – 141, name two countries with physical water scarcity, which:
a could use desalination b could not use desalination

2.5 Soil … a precious resource

You met soil in Chapter 1. It is one of our most precious natural resources. Find out more about it here.

Did you know?

- China has 20% of the world's people …
- … and only 9% of the world's land.
- So it has bought lots of land in other countries.

Earth's carpet

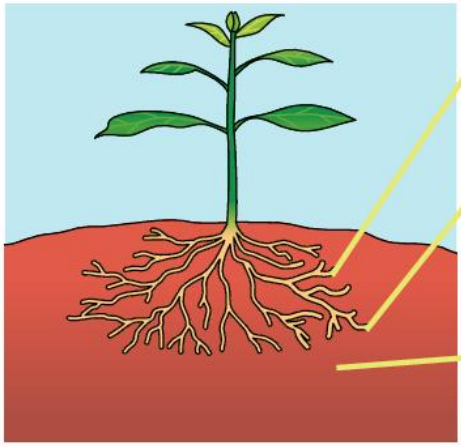
As you saw in Unit 1.3, soil forms when rock is broken down by weathering, and then mixed with rotting vegetation (humus).

It's like a carpet over Earth. But it is more precious than the finest carpet you can buy! We depend on it for most of our food.

What does soil provide?

- Soil provides the **nutrients** that plants need.
- It also provides **water** and **oxygen**.

Look at this diagram. If the soil is missing nutrients, or air, or water, crops will fail.



Nutrients are taken in from the soil through the plant's roots.

Water is taken in by the roots and travels up to the leaves, for photosynthesis.

Oxygen from the air trapped in soil is also taken in by the roots. It is used by plant cells for **respiration**.

Unequally shared

Like all natural resources, soil is not shared equally. Some places have a lot more than others. It depends on …

- **the type of rock in a place**. Some rocks, such as granite, break down to soil only very slowly.
- **the climate**. Most chemical weathering of rock needs water. It also speeds up as the temperature rises. So soil will form very slowly in cold dry places.
- **relief**. Soil slides off steep slopes, or gets washed off by rain.

A renewable resource?

No. Soil is not a renewable resource.

Earth has only a limited amount of land that's suitable for crops. The rest is too steep, or high, or cold, for example.

New soil is continually forming below ground, as the **bedrock** weathers. But this takes time. And meanwhile, we are destroying soil at a much faster rate, as you'll find out next.

▶ *Soil is usually deepest on low flattish land, in warm climates with frequent rain. But it also depends on the type of rock.*

We destroy soil

Our population keeps on growing. So we need more and more food. But meanwhile, around the world, the amount of fertile soil for crops is shrinking!

B

We bury soil under concrete. And once buried, it may remain buried for ever. (Or for as long as humans last.)

C

We contaminate it with dust and fumes from factories and mines, and bury rubbish in it at landfill sites.

D

We cut down trees and other vegetation that helped to protect it. So it gets eroded by wind and rain.

E

We let too many animals graze on it for too long. The soil ends up bare, **compacted**, and at risk of erosion.

F

Bare soil develops a hard crust. So rain runs off it, rather than soaking through it. The soil below gets drier and drier.

G

In places, we grow crop after crop until the soil has no nutrients left. Or else poison it with too much fertiliser.

Erosion, degradation, and desertification

- Around the world, **soil erosion** – as in photo **D** – is a major problem. Topsoil that could have produced crops is carried away. What a waste!
- In many areas, the soil is poor quality, through misuse. We say it is **degraded**.
- In dry regions, the lack of rain adds to the problem. The land may become so degraded and dry that it's like desert. We call this **desertification**. You can find out more about it in the next unit.

Did you know?

- Every year, Earth's farmland loses about 24 billion tonnes of topsoil, through erosion by wind and water.

Your turn

1 Where's the nearest soil to you? What's growing on it?

2 Explain why there is not much soil:
  a in the Sahara b on Dartmoor (see the photo on page 18)

3 a What is *degraded* soil?
  b From photos **B** – **G** above, choose two where the soil appears to be degraded.
  c In photo **A**, It is *not* degraded. What's the evidence?

4 See if you can explain why:
  a it's bad for land to be grazed until the soil is bare
  b growing crop after crop on soil can leave it useless
  c it's hard to grow anything on *compacted* soil. (Glossary?) Try to imagine you are a root!

5 Do you think we may be reducing the amount of land available for growing crops, in the UK? If yes, in what ways?

2.6 Desertification in the drylands

In Earth's drylands, desertification is a major problem. Find out more here.

Farming without hope

Mariam bashes at the ground with a stone. The soil is baked hard on top – and underneath, as dry as a bone. If only she had a hoe! That would make life easier. But she can't afford one.

When she has finished, she'll plant the seeds like she does every year, and pray for rain. This patch of ground, and two goats, are all she has to feed the family.

But she knows that even if the rains do come, and even if no more soil gets washed away, the crop will be poor. Because, year by year, the soil is losing its goodness. If only she had the money for fertiliser!

It is hopeless. But she can't give up. What choice does she have?

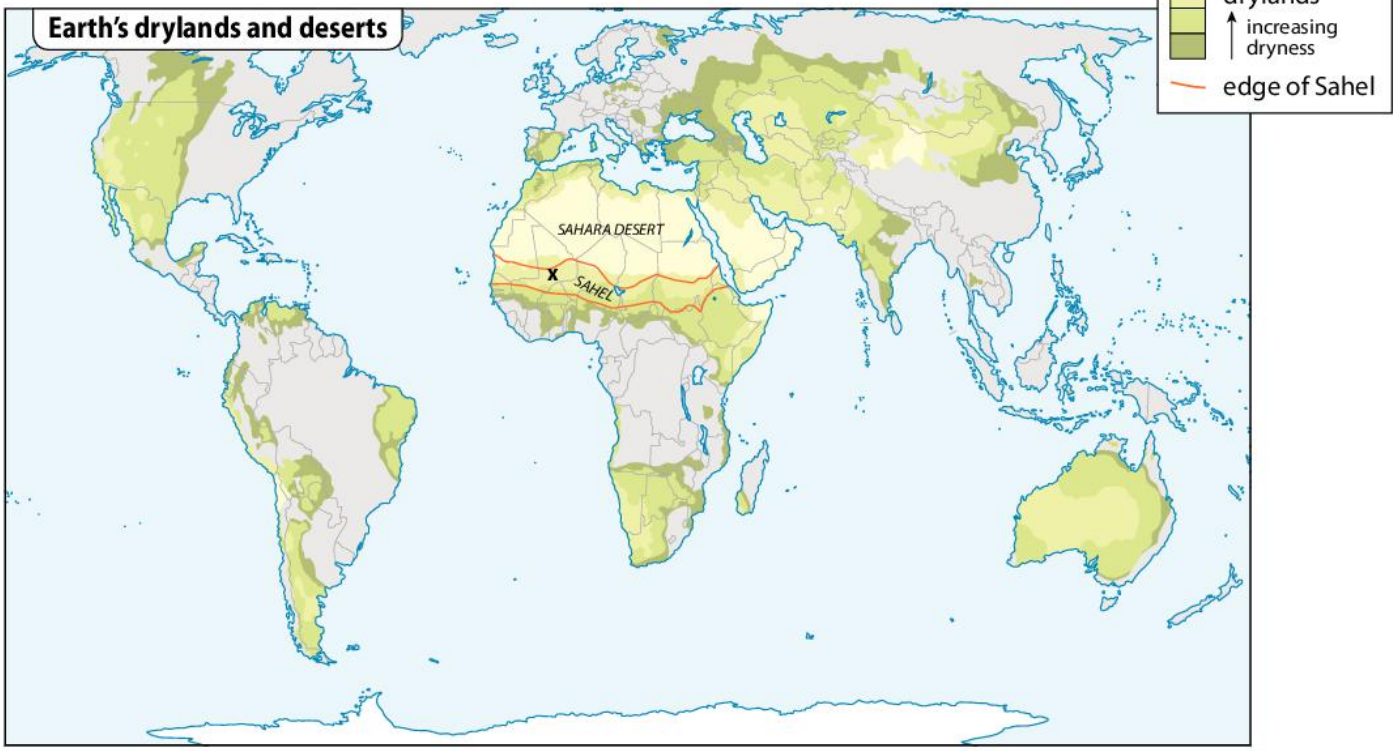
▲ *Mariam on the way to her patch of farmland.*

Earth's drylands

Mariam lives in Mali, a country in West Africa. It is at **X** on the map below. It's in a region called the **Sahel**, which lies south of the Sahara desert.

The Sahel is part of Earth's **drylands**. The drylands are not true deserts. But they don't get that much rain, and the amount is variable – and the rain that does fall may evaporate very quickly.

Drylands cover 41% of Earth's land surface – and are home to 1 in 3 people. This map shows the drylands and deserts.

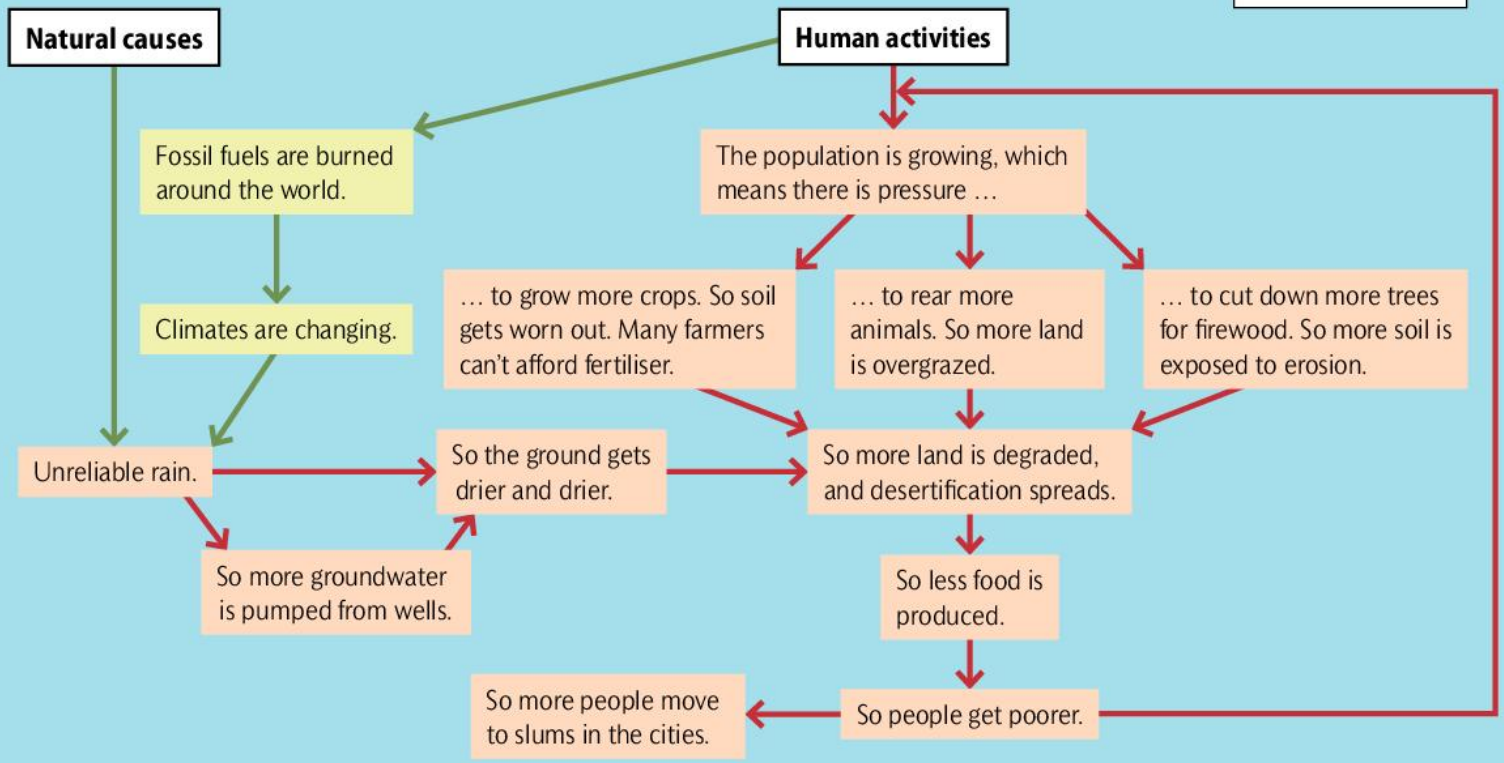


Desertification in the Sahel

Most of the Sahel is suffering from desertification. Why? Low rainfall is just one factor. Human activities, and poverty, also play a big part. Look:

Key
- world-wide
- in the Sahel

The causes of desertification in the Sahel



Not just the Sahel …

Desertification is a problem across Earth's drylands – on every continent. It's especially severe in Africa and Asia, but it occurs in Europe and the USA too.

In the USA, people are much better off than in the Sahel, and population growth is much slower. But even without those pressures, there's still desertification – through overgrazing, and tree loss, and erosion, and poor water management.

What can be done to restore land? See examples from the Sahel in the next unit.

▶ *Desertification is a major problem in northern China.*

Your turn

1 a What are *drylands*? (Glossary?)
b Do all the inhabited continents have drylands?
c Name two European countries with drylands. (Page 141?)

2 The Sahel is a drylands region.
Name five countries which lie at least partly in the Sahel.

3 Much of the Sahel suffers from desertification.
What does *desertification* mean?

4 How does this contribute to desertification in the Sahel?
a cutting down trees for firewood
b poverty
c population growth
d unreliable rains

5 Desertification forces people to move from farms to cities.
Could this solve the desertification problem? Explain.

6 Why is it important to tackle desertification?
Answer in just 30 words.

2.7 The fight against desertification

So … what can we do, to fight desertification ? Find out here.

Think about this !

- Earth is expected to gain 2.5 billion more people, between 2015 and 2050. And they all need food.
- Most of the population rise will be in the world's poorest countries – and many of them have drylands.
- But every year, the drylands are losing more and more land to desertification. It is already affecting *over one billion people* !
- Climates are changing too … and some drylands will become even drier.

So how can we feed everyone ? There is a crisis ahead.

Did you know ?

- Scientists have grown 'meat' in the lab.
- Add colour and flavour, and it tastes like the real thing.
- It could reduce the need for farmland by up to 90% !

Fighting desertification in the Sahel

A – **F** below are examples of what's being done to fight desertification, in Mali and other countries in the Sahel.

A

Plant trees and bushes. They shelter soil from erosion, and help rain soak into soil. You can plant crops between them.

B

Dig zai pits. Dig a hole, line it with leaves or vegetable scraps, and animal manure, and put a young plant in it.

C

Microdose. If you don't have animal manure and can afford fertiliser, put small amounts around the plant roots.

D

Store any rain that does fall. Dig shallow pits with rims, to trap rain. Then plant in the pits.

E

Irrigate if you can – sparingly. Use drip irrigation, where water drips in beside the roots, from tiny holes in pipes.

F

Plan grazing. Let an area be heavily grazed for a short time. Then move the animals on. Their manure helps the soil.

They work!

These methods mostly don't cost much. They are easy to learn. And they work!

So more and more people are experimenting with them. (Very often the farmers are women, and they are keen to try out new farming methods, to feed their children.)

Scientists are working too

Scientists are working to develop new crop breeds that will give higher yields on poor soil, and cope with drought.

Will the battle be won?

The methods shown in this unit are helping to restore degraded land, and reverse desertification. The examples here are all on a small scale – but word is spreading.

If enough people around the world fight desertification, and look after the soil, perhaps we can avoid world hunger in 2050. But they need to get going. 2050 is not so far off.

▲ *They are planting a belt of billions of trees in northern China, to fight desertification. They call it the Great Green Wall of China.*

Your turn

1 To fight desertification, you must give the soil three things:
trewa *srunnitte* *threels*
Unjumble the blue words!

2 The first thing people do to fight desertification is … plant trees and bushes. Explain why this is so important.
See if you can give *three* reasons.

3 Look at photo **C**. Farmers in the UK do not usually do this. Why not? See how many reasons you can come up with.

4 Imagine you are Mariam. You were lent a shovel. You chose *one* of the methods **A** – **F** to help your crop grow. And the good news is: it worked!
Tell us which method you chose, and why. And now you have more plans for your farm. Tell us about those too.

5 Read the *Did you know?* on page 36, about synthetic meat. Is it a good idea? Write an interesting blog about it, giving your opinion. At least 70 words!

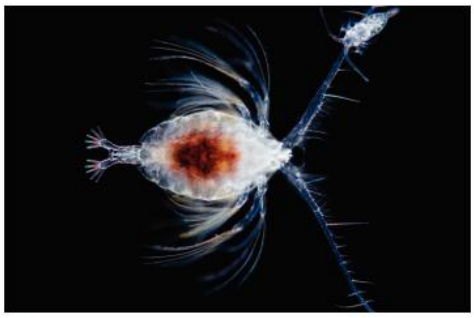
2.8 Oil for energy

Oil is the world's top natural resource for energy. How does it form? Who has it? What are the problems? Find out here.

How does oil form?

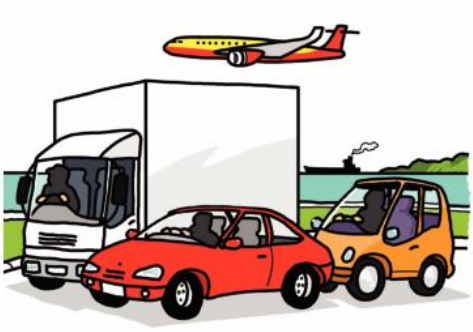
Oil forms from tiny ocean creatures. They die, and get buried in sediment. This becomes sedimentary rock. Inside the rock, heat and pressure turn their remains into oil. It moves up through the rock, and collects as **oil deposits**.

We drill into the ocean floor to reach the oil. But oil wells are found on land too, where ocean floor has been raised and drained, over millions of years.



▲ *Oil forms from tiny organisms like this zooplankton (seen under a microscope).*

You depend on oil



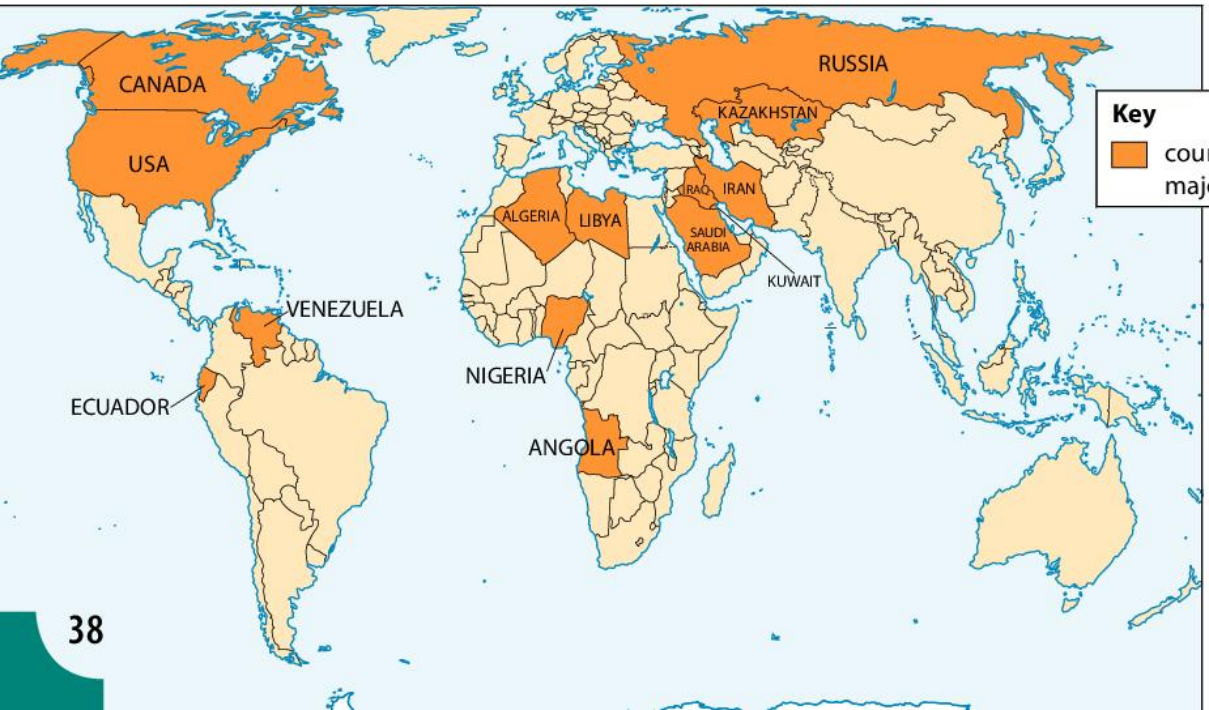
You depend on oil to go places. Petrol, diesel, jet fuel for planes, and fuel oil for ships: they all come from oil.

The central heating in some homes uses oil. And some power stations burn it to make electricity.

Oil is also the starting point for medical drugs, plastics, synthetic fabrics, hair gel, and much more.

Who has it?

Everyone wants oil. So countries with lots of oil can earn a great deal by selling it. Between them, the countries marked on this map have over 90% of the world's known oil reserves. (Many other countries, including the UK, have small deposits.)



Did you know?

- The UK buys quite a lot of oil from Africa.

What if...

- ... humans hadn't discovered oil?

Why...

- ... do some countries have so much more oil than others?

▲ *In 2010, an explosion on an oil rig in the Gulf of Mexico killed ten people, and led to the biggest ever oil spill. An oil well gushed for 87 days before they could cap it.*

▲ *The oil spill devastated marine life in the Gulf of Mexico. (Look on the map on page 140.)*

Is it all good news?

No. There are downsides to using oil.

- When it burns it produces carbon dioxide. Scientists say this gas is the main cause of **global warming**.
- It produces other harmful gases too. For example sulphur dioxide, from the sulphur it contains. This gas gives **acid rain**.
- **Oil spills** from oil platforms, tankers and pipelines harm the environment.
- Some oil-producing countries are politically unstable. We may not want to, or be able to, buy oil from them. So we can't be sure of steady oil supplies.

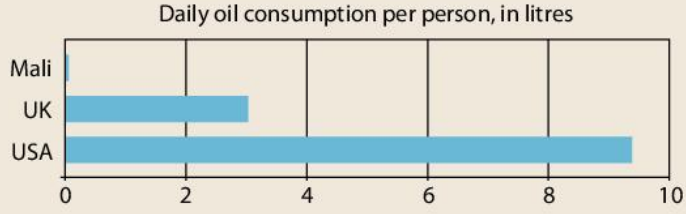
We are cutting back …

Governments are trying to slow down the rise in carbon dioxide emissions. That means switching from oil (and coal and gas, the other fossil fuels) to clean, renewable sources of energy. Read about these, for the UK, in the next unit.

▲ *Oil is moved around the world by pipeline, or in tankers like this one. It is measured in units called **barrels**. (A barrel is 159 litres.)*

Your turn

1. When you fly off somewhere on a plane, it's thanks to billions of tiny sea creatures. Explain why.
2. Name five of the world's top countries for oil deposits.
3. Oil is still forming, 24 hours a day, deep in the ocean floor. But we call it a *non-renewable* resource. Why?
4. The world consumes about 14 billion litres of oil *a day*. Why do we use so much of it?
5. Every country uses some oil. This bar graph shows average oil consumption in litres per person, per day, for three countries. See if you can explain why the amount is:
   a. about three times more for the USA than the UK
   b. about sixty times more for the UK than for Mali
6. Countries around the world would like to switch from using oil and other fossil fuels. The main reason is … ?
7. In reality, the world uses more and more oil every year! See how many reasons you can think of, to explain why. You could show your answer as a flow chart, like the one on page 35.



2.9 Renewable sources of energy in the UK

This unit is about renewable sources of energy in the UK. You will explore a map for them.

Switching from the fossil fuels

The British government aims to cut back on **fossil fuels** – coal, oil, gas – and get 15% of our energy from **renewable** sources, by 2020.

These renewable sources are used mainly to give energy as **electricity**. So check out the blue box on the right.

Making electricity

- Most electricity is made by spinning a coil of wire in a magnetic field.
- The coil of wire is attached to a rotating drum called a **turbine**.
- So you need a way to spin the turbine.
- Most power stations burn fuel to heat water, to make steam. Then a jet of steam spins the turbine.

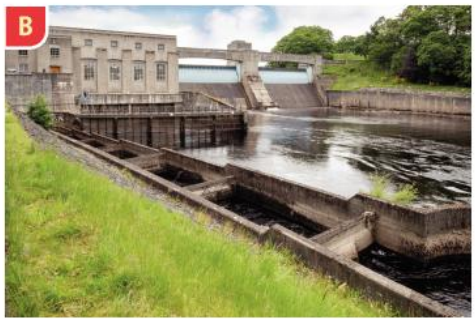
Electricity from renewable resources

Look at the renewable resources we use to make electricity, here in the UK.

A

Power stations like this one on Teeside burn **biomass** (wood, straw …) or **waste**, instead of fossil fuels.

B

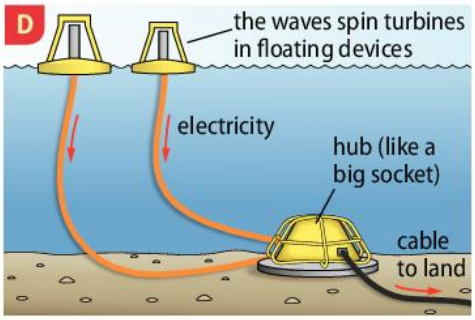


In a **hydroelectric** power station, a fast-flowing river spins the turbines to make electricity.

C

On a **wind farm**, the wind turns the blades, which are part of the turbines. You need an exposed, windy site.

D



Off the coast of Cornwall, **waves** are making turbines spin. The electricity flows to a central hub, then to land.

E

As it rises and falls, the **tide** slowly spins these underwater turbines, off Caithness in the north of Scotland.

F

But on **solar farms** like this one in Oxfordshire: no turbines! Sunlight strikes solar cells, giving electricity.

Your turn

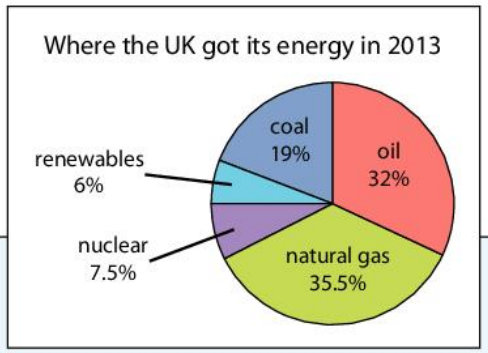
1 Look at the map on page 41. See if you can find a pattern in the locations for these – and explain it! Page 139 will help.
   a hydroelectric power stations
   b solar farms
   c *onshore* wind farms (the ones on land, not at sea)

2 Which of the renewable sources of energy shown above:
   a produce no harmful gases b do not need turbines?

3 Look at the two pie charts on page 41.
   a What was the UK's main source of energy, in 2013?
   b What was the percentage for renewables that year?
   c Which renewable source provided most electricity in 2013?

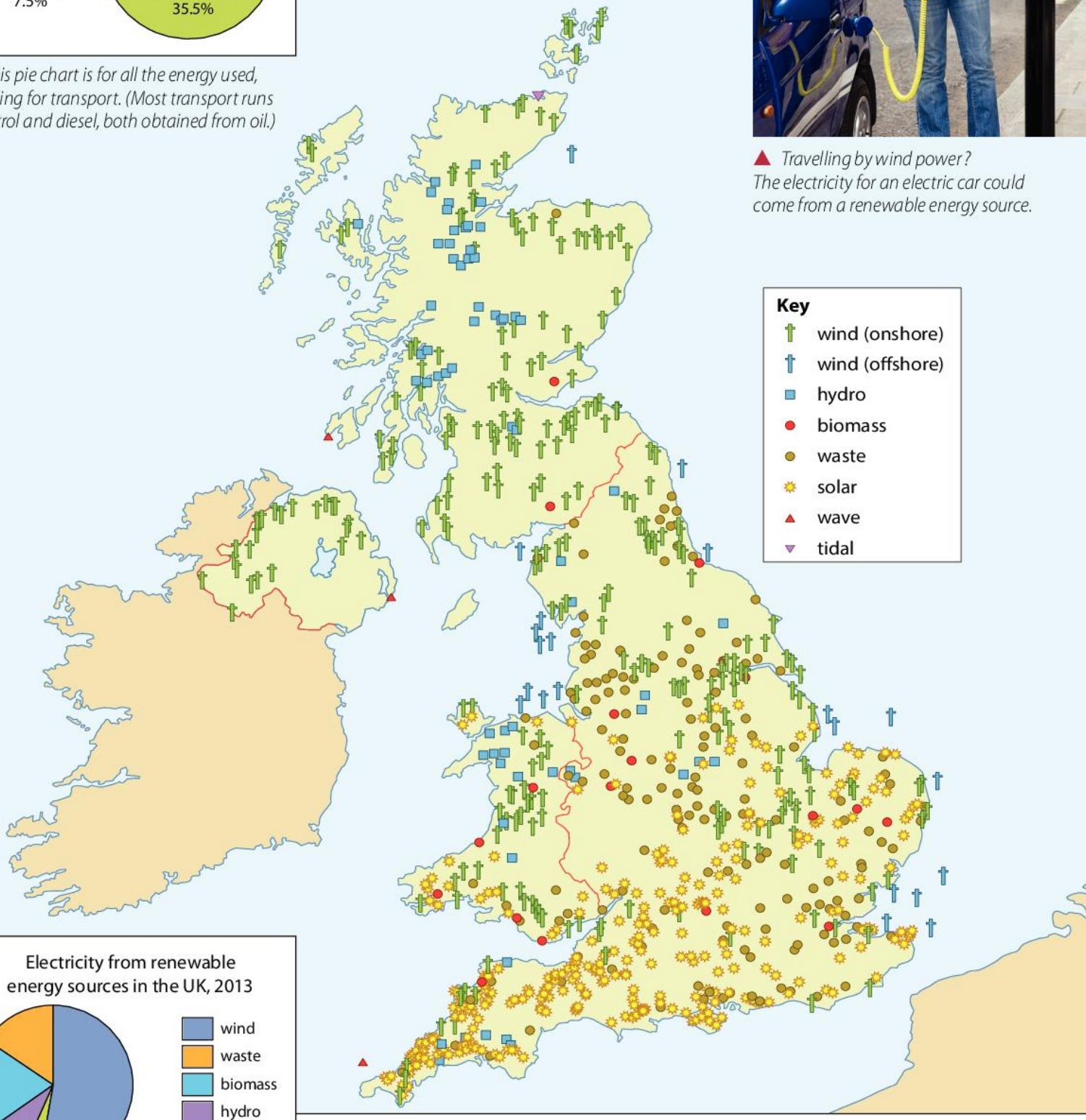
4 Pick out a European country that you think has fewer sources of renewable energy than the UK. Explain your choice!

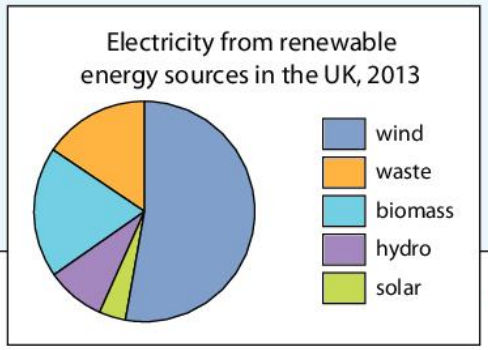
5 Wind energy is starting to replace petrol. Explain how.



▲ *This pie chart is for all the energy used, including for transport. (Most transport runs on petrol and diesel, both obtained from oil.)*

▲ *Travelling by wind power? The electricity for an electric car could come from a renewable energy source.*





◀ *Electricity from renewable energy sources in the UK, 2013.*

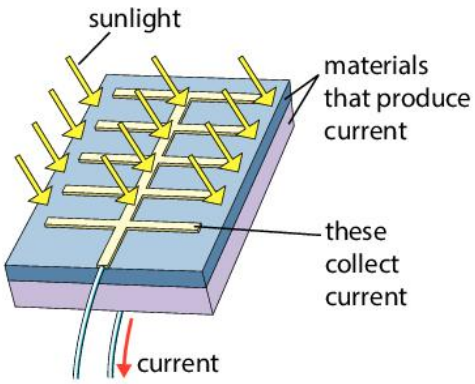
2.10 Solar power around the world

Here you'll learn more about solar power, and how it's being used around the world.

Did you know?
- The first ever solar cell was made in 1839 ...
- ... by a 19-year-old French scientist.

Straight from the sun

Solar power means energy from sunlight. When the sunlight strikes a **solar cell**, a current is produced.



Place a solar cell where it will catch the sun. Wires carry the current away. You can use it to light or heat a room.

You can buy panels of solar cells just for your own house. For example to put on the roof, as here.

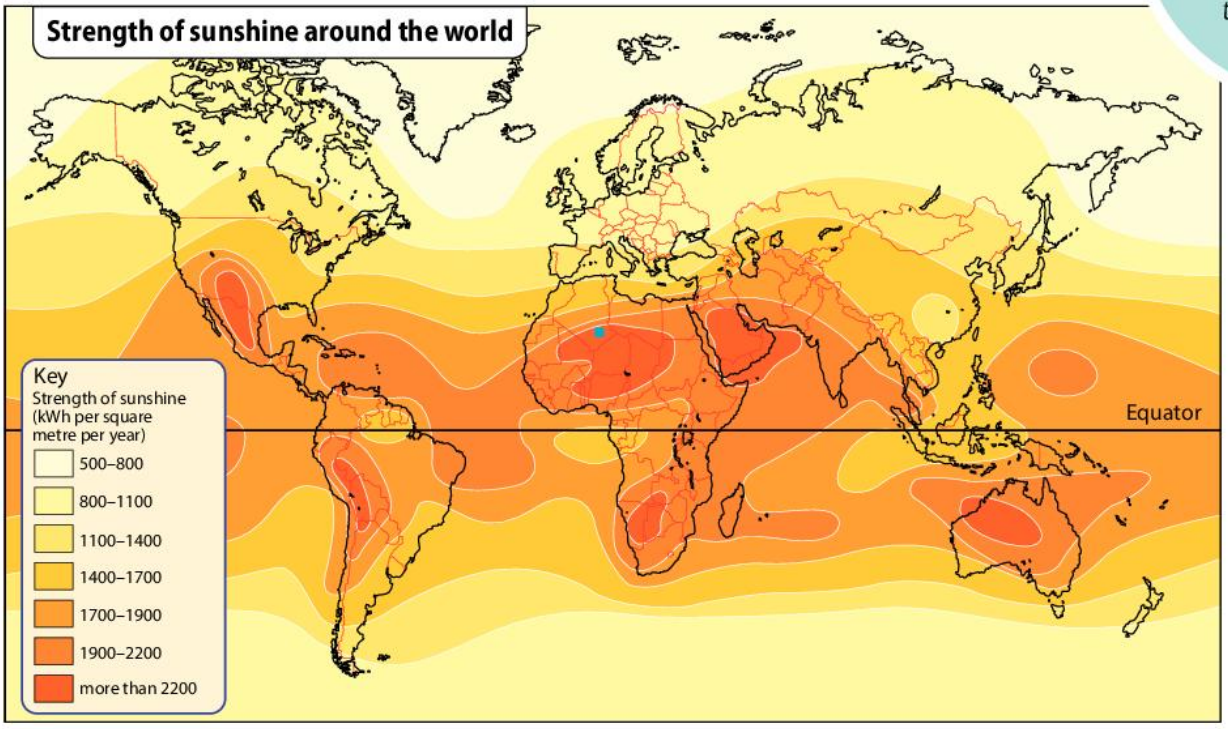
Or set up a big solar farm in a sunny place, like here in the USA. Cables carry the electricity to many homes.

It's instant electricity. And no harmful gases are produced – so no pollution.

Did you know?
- In the past, ash from volcanic eruptions has blocked sunlight from Earth ...
- ... and caused temperatures to plummet.

Sunshine around the world

The UK has a number of solar farms. But many countries have much stronger sunshine, and more potential for solar power, than we do. Look at this map.



What if...
- ... we had to pay for sunshine?

▲ *Most homes without electricity use kerosene lamps. (Kerosene comes from oil.) They are a fire hazard, and give off nasty fumes.*

▲ *The evening news. Lhamo and her dad listen to their solar-powered radio, by the light of a solar lantern, in a remote rural village in India.*

A winner for poorer countries?

Think about this: 1 in 5 people around the world has no electricity at home.

Most live in rural areas in countries which can't afford to build enough power stations, and set up the pylons and cables, to carry electricity to everyone.

With solar power, you don't need all that. A home can have its own electricity.

Most of these poorer countries have plenty of sunshine. So, as solar cells get cheaper, more and more homes are being lit by solar power.

▲ *Another use of solar power: making water safe to drink. River water is poured into the top container, where it's boiled by solar power. (The lid has solar cells.) The steam condenses to give clean water in the lower container.*

Exporting solar power

Look for the little blue square on the map on page 42. It's in the Sahara Desert. It represents an area of 254 sq km. An area of this size, where the sunlight is strongest, could provide enough solar power for the whole world!

It would cost a fortune to set up a giant solar park in the Sahara, and lay the long-distance cables. People worry about terrorist attacks too. But smaller projects to export solar power from sunny countries are very likely, in the future.

Your turn

1 What is a *solar cell*? Answer, then check the glossary!

2 Here are six statements about solar power.
For each one, decide whether it's true, or false.
- **A** With solar cells, a home can provide its own electricity.
- **B** You must live near a city to use solar power.
- **C** Solar power is used only in rich countries.
- **D** Solar power increases global warming.
- **E** You can't make solar power at night.
- **F** With solar power, the source of the energy is free.

3 a Which do you think are the three main advantages of solar power? List them in order of importance.
b Now see if you can think of any disadvantages.

4 a Which *continent* has most potential for solar power? How did you decide?
b Which of these countries has *least* potential for solar power: Greenland, Spain, or Mali? (Pages 140 – 141.) Try to explain why, very clearly.

5 Solar power is used in many homes in the UK. But it helps many people in poorer countries even more. Explain why.

6 You are an inventor. And here's a challenge.
a Invent something that uses solar power. Say for tourists, or mums with toddlers, or homes in poorer countries.
b Draw a labelled sketch of it.
c Then make up a name and a logo for it.

2.11 But what about other species?

We are spreading everywhere, and using more and more of Earth's resources. So how do we affect other species? Find out here.

We humans get everywhere

Our species, *Homo sapiens*, has spread almost everywhere, in our quest for land, and water, and oil, and other resources. We live in almost every environment.

But we are not alone

We are just one of Earth's species. There are 1.7 million other known species. And many more unknown ones – hidden in the sea, and underground, and in isolated places. Some say there could be 50 million species on Earth today.

How are they all doing?

Not very well! Our human population has more than doubled in the last fifty years. But populations of other species have fallen. There are fewer lions, tigers, polar bears, great white sharks, hedgehogs, bumble bees …

We think that at least 10 species become extinct every week – but it could be as many as 700! Many thousands will disappear in the next fifty years. Look …

Did you know?

- Amphibians (such as frogs) are particularly at risk from climate change and pollution …
- … because of their moist, permeable skin.

What if…

- … all the world's bees died out?

A

41% of known amphibians are at risk. Like this tiny tree frog from Panama.

B

And a quarter of known mammals. Like this lemur from Madagascar.

C

And one in eight known species of birds. Like this cinclodes from Peru.

A mass extinction – caused by humans

Scientists warn that a **mass extinction** is underway. And it is different from all the other mass extinctions in Earth's history. *This one is caused by humans.*

How are we doing it?

- We cut down forests, and clear land for farming and building. So other species lose their habitats.
- We kill species off by polluting the air, soil, rivers, and groundwater with pesticides and other harmful chemicals.
- We hunted, and fished, many animals to extinction in the past. We still do.
- We pump carbon dioxide into the air by burning fossil fuels. Experts say this gas is making Earth warmer. Species that can't adapt are already dying out.

D

▲ *The rainforest is home to many thousands of species. So when it's chopped down …*

▲ *Hedgehogs used to be common in the UK. Not now. Loss of habitat is one reason. Thousands are also killed on the roads.*

▲ *Bumble bees pollinate crops, and wild plants, and trees. Their decline in the UK is at least partly due to pesticides.*

Not only in faraway places

Extinction is not only in faraway places. It is happening in the UK too. Starlings, hedgehogs, bumble bees, bats, and dormice are among species in sharp decline.

So what can we do?

Here are some of the things we could do …

1. 'Adopt' a species that's at risk. Find out how to help protect it. Then do that. Saving even one species from extinction would be wonderful.
2. Farming has destroyed many habitats. So encourage farmers to set aside wild areas for species to live in. (They are being paid to do this, in the UK.)
3. Demand that chemicals which harm bees and other wildlife are banned.
4. Think about what we're buying – and perhaps change our minds. Is that furniture made from rainforest trees? Are those vegetable oils from sustainable sources? Will that spray harm the environment?

The threat to species is real, and growing. We must act now. Next year is too late.

▲ *Much of Indonesia's rainforest has been destroyed to make way for plantations of oil palm trees, like this one. Palm oil is used in bread, cakes, sweets, soap, shampoo, cosmetics, and many other products.*

Your turn

1. Of all groups of animals, amphibians are at most risk of extinction. What are *amphibians*? (Glossary?)
2. There are nearly 7.3 billion humans on Earth today. A hundred years ago, there were about 1 billion of us. Suppose we had stayed at 1 billion. Would this have made a difference to other species? Explain in 55 words!
3. What is a *mass extinction*? (Glossary?)
4. a Look at photo **D**. What do you think has happened to:
   i the animals which used to live here?
   ii the plants which used to live here?
   b Explain why the destruction of rainforest plays a very big part in the extinction of species.
5. Are *you* linked in any way to the extinction of other species? Think about it. Then give reasons for your answer. (Photo **G** might help ?)
6. You will speak on behalf of one animal shown in this unit. Choose your animal, and write down what you will say.
7. Think about these two people's opinions. Then write a response to one of them – or both!

3 Earning a living

The big picture

This chapter is about people working for pay. Here's the big picture …

- People do hundreds of different kinds of jobs, to earn a living.
- The jobs can be divided into different groups or **sectors**. For example, farmers are in the *primary* sector. Factory workers are in the *secondary* sector. Your teachers are in the *tertiary* sector.
- A country's **employment structure** tells you what % of its workers are in each sector.
- Employment structure changes over time, and is different in every country.
- The things you buy are produced by workers in different sectors – and perhaps in different countries too.

Did you know?

- In 1833, they made it illegal for children under 9 to work in factories in Britain.
- But if you were 9 – 13, you could do factory work for 9 hours a day!

Your goals for this chapter

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

- What is the difference between *goods* and *services*?
- What do these terms mean?
  employment structure *primary sector* *secondary sector*
  tertiary sector *quaternary sector* *manufacturing* *the economy*
- Give at least two examples of jobs in each employment sector.
- How has employment structure changed over the years, in the UK?
- The UK lost many of its manufacturing jobs, in the last 60 years. Why?
- Describe the changes in employment which have taken place in Doncaster, since its early days.
- Clothing factories are really important to Bangladesh. Why?
- Explain how workers in different sectors play a part in bringing you goods such as a mobile phone.

Did you know?

- Every year, the UK spends more on imports than it earns from exports.
- This worries people!

Did you know?

- The British government collects about £550 billion a year in taxes …
- … and uses the money to run the country.

What if…

- … everyone worked for only three days a week?

Why…

- … do they make you go to school?

And then …

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

Your chapter starter

Look at the photo on page 46. What is he doing?

Do you think it counts as work? Give reasons.

About how many people in the UK work for a living? Have a guess!

Why do they bother?

How would it affect the UK, if everyone stopped working?

3.1 The UK at work

Every day, millions of people in the UK go out to work. What kinds of work? Find out here.

▲ *Off to work we go.*

People in employment

In the UK, about 31 million people are working for pay. That's a lot of people! And we all depend on them.

First, they provide **goods** and **services** we need.

And second, most pay the government part of what they earn, as **income tax**. This money in turn pays for the National Health Service, and helps to fund schools, the police, and other services.

What do the workers do?

There are hundreds of different kinds of jobs. But they fall into just four groups or **sectors** of employment. Look:

The **primary sector** is where people take things from the land and sea. For example farmers, fishermen, miners, oil workers, forestry workers. Often what they produce is **raw materials** which other people will process. (See next.)

In the **secondary sector**, people make or build things, often using raw materials from the primary sector. This group includes factory workers, house builders, and people constructing roads and railways.

In the **tertiary sector**, people provide services for other people. For example teach them, or care for them when they're ill, or sell them things in shops, or serve them in cafes, or entertain them.

In the **quaternary sector**, people use their high-level expertise to help other sectors. For example, they develop new types of medical treatment, or new technology, or help companies make financial decisions.

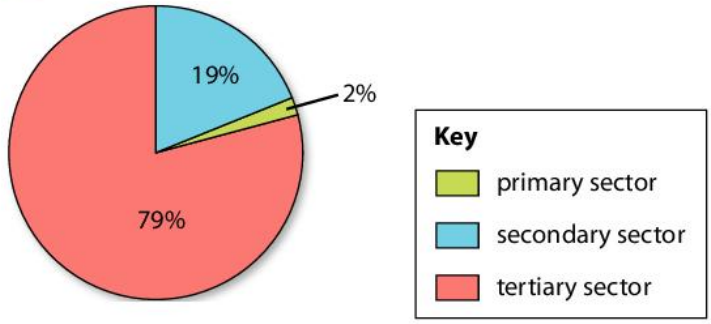
The structure of employment

Pie chart **A** shows the **employment structure** in the UK – the percentage of people working in the different sectors.

There's no slice for the quaternary sector. That's because it's a small sector, and usually treated as a subset of the tertiary sector.

As you can see, the tertiary sector has by far the biggest slice. Around four in every five people in the UK provide services to other people.

A **Employment structure in the UK**



The economy

People earn money for **producing** and **supplying** goods and services. Other people buy and use or **consume** these goods and services.

The **economy** means all the business activity going on in producing, supplying, and consuming, goods and services.

Drawing **B** shows just a very small part of the UK's economy – the part concerned with processed food.

When the quantity of goods and services produced, supplied, and consumed is rising, with more and more money flowing around, we say the economy is **growing**.

But an economy can also **shrink**. For example, factories may close. People lose their jobs, and can't afford to buy things.

B

▲ *A very small part of the economy: processed food. (Pizzas, hamburgers, ice cream, biscuits …) The purple arrows show the flow of money. The green ones show the flow of goods.*

So how is the UK doing?

Fine, thanks! The UK is not a big country, compared to many. But it produces a lot of goods and services, so its economy is usually in the world's top ten, by value.

Your turn

1 a What are: i goods? ii services?
b See if you can give four examples of each.

2 Employment can be divided into four sectors. Which sector do you think this person belongs to?
a a quarry worker, taking rock from a limestone quarry
b a magician at a children's party
c a person developing a new flu vaccine
d the postman
e a woman building cars in a Toyota factory
f a person developing a mini-phone for your wrist

3 Now list ten other jobs, and say which employment sector each is in. (Think about people you know?)

4 About 40% of the food we eat is *imported*. (Glossary?) Suppose the UK stops importing food. What do you think might happen to the primary sector? Explain.

5 a What does the term *the economy* mean?
b Do you think this is part of the economy? Try to explain.
i buying sweets in a shop near school
ii a teacher teaching your class
iii singing to yourself
iv playing in a Premier League football match

6 A couple of million people in the UK are *unemployed*. (Glossary?) The government wants to reduce unemployment. See if you can explain why.

3.2 So where are the jobs?

Some kinds of work are tied to a particular type of location. Some can be done anywhere. Find out more here.

Where will you work?

It's time for you to earn your living. (Gulp!) So where will your workplace be?

If you want to farm, you'll almost certainly be living in a rural area. If you're a sheep farmer, it might be mountainous, and quite remote.

If you want to set up an ice-cream shop, you'll need lots of customers. So … head for quite a big town, or city, or a seaside resort?

If you're a web designer, you can work anywhere. You just need good internet access. What about one of the Orkney islands, off Scotland?

Factors that influence where the jobs are

Factories, shops, and other businesses don't usually arrive in a place by accident. People think hard about where to locate them.

For example, they'll think about some or all of these questions:

- Where are the materials we'll need?
- Will we find people here with the right skills, to work for us?
- What are the transport links like? (Roads, rail, airports, ports ...)
- Does the land, or building, cost a lot to buy or lease?
- Will the government give us a grant to set up here?

▲ *The government helps small businesses to set up in some places. For example with free advice, and grants.*

The primary sector

In the primary sector, you make use of Earth's natural resources. You grow things on the land, or extract things from the land or sea.

So that helps decide where you work.

If you want to grow crops, you'll look for quite flat land, and fertile soil.

A quarry will start up where there's suitable rock, and permission to quarry. Good road or rail links will help, for moving the stone to customers.

▶ *Trucks on the motorway, delivering goods. It's the economy in action.*

▲ *A tanker with oil for the UK. Refineries are built close to where the oil comes in. (The refinery shown here is at Fawley, near Southampton.)*

▲ *If shops are in busy places, where shoppers can find them easily, they are more likely to do well – and take on more staff.*

The secondary sector

In much of the secondary sector, factories process raw material from the primary sector. So they may set up close to the source of the raw material.

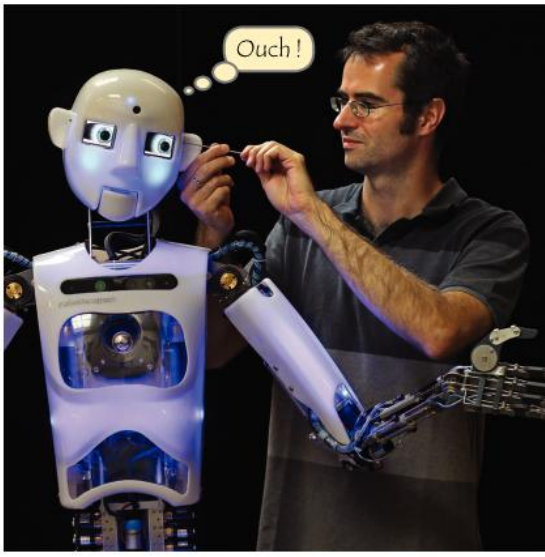
For example rock is used to make cement. Rock is heavy, bulky stuff. So a cement works may start up close to the quarry, to save transport costs.

The tertiary sector

You provide services for people. So you need to be where you can reach people easily, or they can reach you. (It could be on the internet!)

The quaternary sector

This sector depends on specialist knowledge, and brain power.
Many high-tech jobs are located in **science parks** which are often linked to universities. They take on bright graduates (like you perhaps, one day).
There are science parks, and other research centres, all over the UK.



▲ *Robot research is in the quaternary sector. This is RoboThespian, made in Cornwall. It can move, sing, and speak many languages.*

Your turn

1 Here are some jobs people do in the UK.
- **A** outdoor ski instructor (in Scotland)
- **B** crime reporter for a newspaper
- **C** optician
- **D** online A-level tutor
- **E** lobster fisherman
- **F** fiction writer
- **G** heart surgeon

Which of these jobs:
- a depend on Earth's physical features?
- b are more likely to be found in a city than in a rural area?
- c are **footloose**? (Glossary?)

2 You have a big plan! To set up a company to compete with Amazon. People will order goods from you, online.
- a i List four things you will think about, when choosing a site for your first big warehouse.
- ii Now see if you can put them in order of importance, the most important first.
- b Next, write an ad to find warehouse workers. Describe the skills and qualities needed, and the benefits you will offer.

3 Some workers who provide goods and services for us are *not* in the UK. See if you can give 5 examples. (Hint: oranges.)

4 In 50 words, describe what work *you* would like to do in the future, and where, and what education and skills you'll need.

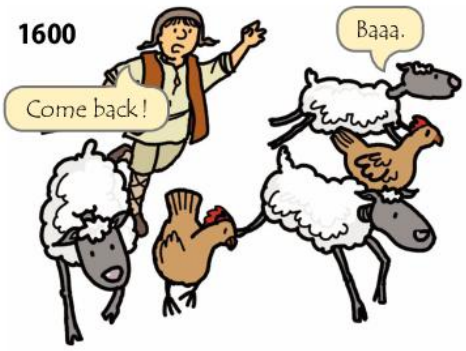
3.3 The UK's changing employment structure

In the past, the UK's employment structure has been very different than it is today. Here you can find out how, and why.

Key
- primary sector
- secondary sector
- tertiary sector

Once upon a time …

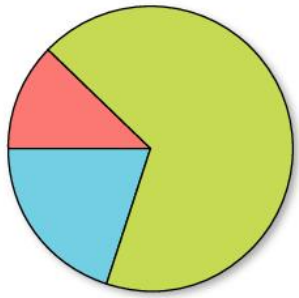
Once upon a time, most people in the UK were in farming!



It's 1600. If you are living now, you'll probably be working hard on a farm, even at your young age. Most people in the UK are in farming.

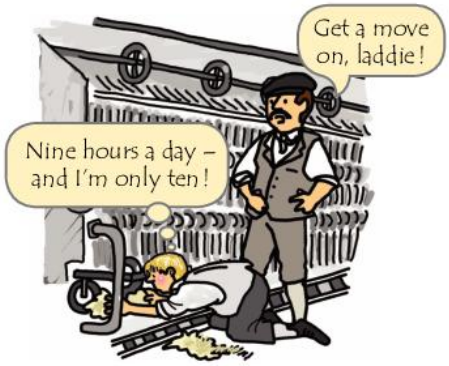
But there are also people making things in workshops – like shoes, and furniture. And providing services – for example as servants to richer families.

Employment structure in 1600



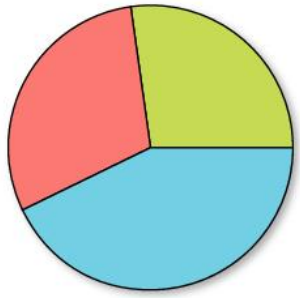
Overall, the employment structure looks something like this, with the biggest slice for primary. (The colour key is shown above the pie.)

Let's roll on to 1850. There have been big changes in farming since 1600. Farms can now produce a lot more food – with fewer people.



But an even bigger change has taken place: the Industrial Revolution. Even at your age, you might be working in a factory now, or down a coal mine.

Employment structure in 1850

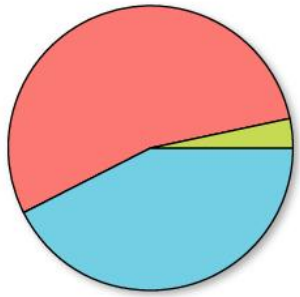


Thanks to all the new factories, the secondary sector has grown.
It will grow further over the next few decades, as more factories open.

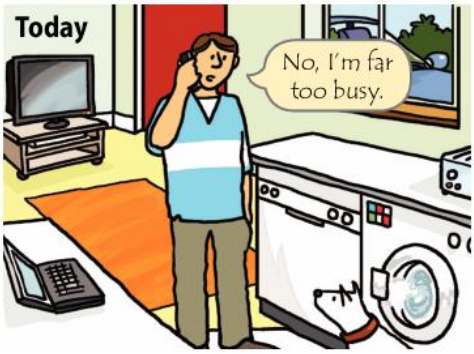
It's 1970. No factory work for you! Young people must now stay in education till 16. But life is getting tough for many working people …

… because factories are starting to close. Reason: they can't compete with factories in other countries, which can make things more cheaply.

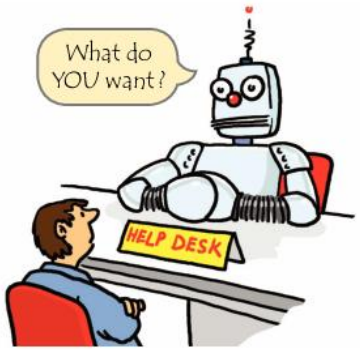
Employment structure in 1970



Coal mines are closing too. And the % of people in farming is still falling.
So the primary sector has shrunk a lot.
But look at the tertiary sector.

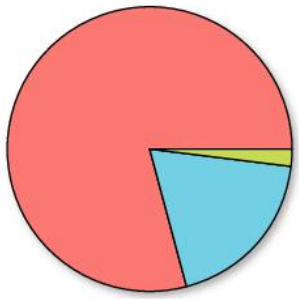


And here we are today. One big change since 1970 is the spread of computers. They're part of all our lives now, in one way or another.



Computers, the internet, and other technology have led to a big growth in services – and especially in the quaternary sector.

Employment structure today



So here's today's pie chart. The tertiary sector is by far the biggest – just as the primary sector was, over 400 years ago.

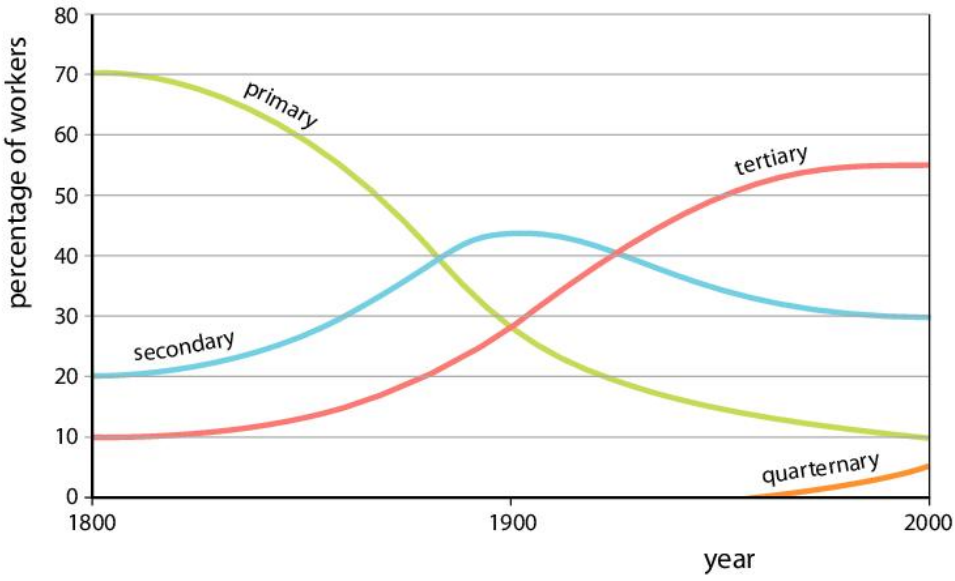
A graph of the changes

This graph shows how employment structure has changed, in the UK.

It is a **model graph**. That means it aims to show the *pattern* of change, rather than exact numbers.

Look at the green line. It shows how the % of workers in the primary sector has fallen.

Changes are still going on. So the UK's employment structure might be very different, 100 years from now!



Not just the UK

Employment structure has been changing in most countries, not just the UK. But the changes do not always follow the same pattern, or take place at the same speed. You can find out more about other countries in Unit 3.5.

Your turn

1 See if you can name:
   a three goods **b** three services
   that we take for granted today, which you would not have enjoyed in the year 1600.

2 Look at the different slices for the primary sector.
   a How has the % of people working in the primary sector changed over the years?
   b Try to give *three* reasons to explain these changes.
   c Suppose the primary sector shrank to zero, in the UK. What might the consequences be? Try to think of three.

3 Look at the graph above.
   a What does the curved blue line represent?
   b Describe how it curves.
   c Now *explain* why it has this shape.

4 *The world wide web (www) became available in 1991.*
   a What is the world wide web? (Try without the glossary!)
   b Name two jobs which definitely did not exist before 1991.

5 In 1870, they passed a law saying that children aged 5 – 13 must attend school. Do you think it would be good idea to leave school at age 13 today? Explain.

3.4 Change in and around Doncaster

Changes in employment affect people's lives. It can be very painful. This unit is about how Doncaster has changed.

Doncaster's story

Doncaster began as a Roman fort at a crossing on the River Don, around 71 AD. It was on the road from London to York, a key Roman town.

It was in a great location. So, over time, the settlement grew into a busy market town, where farmers sold their produce. By the 16th century, it had become a hub for stage coach travel.

Then came the Industrial Revolution. Doncaster became an industrial centre. Over 2000 steam trains were built there. Railways and canals were constructed, improving its transport links. The population grew.

The area was rich in coal, so Doncaster became an important mining centre too. There were mining communities all around it. By 1900, coal mining was the biggest employer.

But about 50 years ago, decline set in. Fewer trains were built in Doncaster. Mines began to close. People lost their jobs. This led to high levels of ill-health and depression, run-down areas, crime, and other problems.

No trains at all are built there now. And in 2015, the last coal mine closed.

▲ *Hundreds of years later … Doncaster still has a lively market.*

The town fights back

Today Doncaster has a new lease of life – again because of its great location.

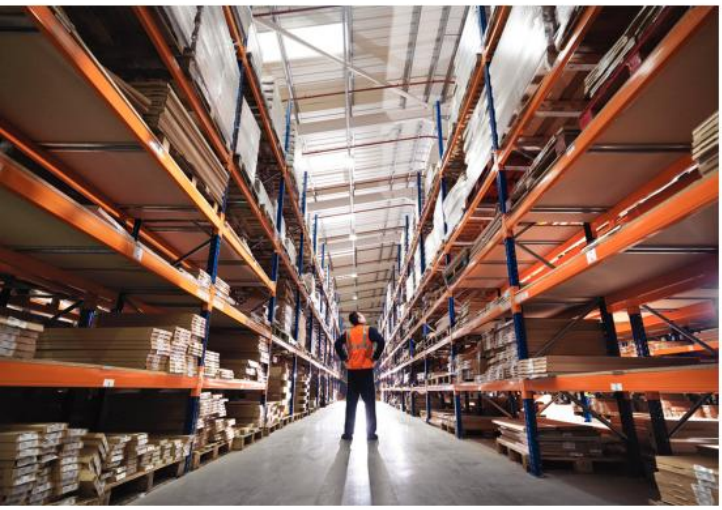
- It has big warehouses for Amazon, IKEA, and Next, from which goods are trucked over a large area.
- It shares a new airport with Sheffield. (Robin Hood airport.)
- An inland 'port', the **iPort**, is being built on the site of an old colliery. It will have a lots of warehousing, with easy access to the motorway and airport, and rail links to ports and the Channel Tunnel.

▲ *Derelict housing in a run-down area in Doncaster. The council will replace it all.*

▼ *The famous 'Flying Scotsman' was built in Doncaster. It travelled between London and Edinburgh.*

▼ *The end of a shift at the Hatfield colliery. The last working colliery around Doncaster, it finally closed in 2015.*

▲ *Doncaster: excellent rail links, and more are planned.*



▲ *Some new warehousing in Doncaster.*

▲ *Doncaster: very well connected!*

Is everything alright now?

Not quite. **Unemployment** in the borough of Doncaster is still above the UK average. There are still deprived areas.

The new warehousing will create thousands of jobs. That's good news. But most won't need much skill, or pay much. So young, qualified people will want to move away.

Now the council aims to bring well-paid jobs to the town, to attract people. It is working hard to make Doncaster a great place to live.

Your turn

1 a Name two activities that flourished in Doncaster after the Industrial Revolution. Say which sector each belonged to.
b To which sector do the new warehousing jobs belong?

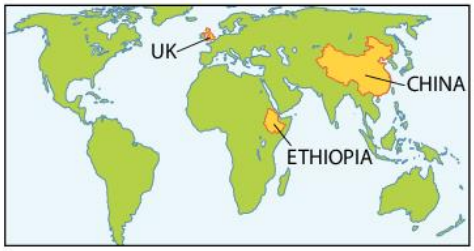
2 a What is *unemployment*? (Glossary?)
b See if you can explain how high unemployment leads to:
i ill health ii rising crime levels iii run-down areas
You could show your answers as flow charts.

3 Using the map above to help you, explain why big companies like IKEA are attracted to Doncaster as a warehousing base. Aim for 55 words. Don't forget to mention ports!

4 Doncaster aims to attract companies which offer well-paid jobs.
a How would that benefit Doncaster? Try to explain.
b Would this help Doncaster to achieve its aim? Explain.
i a new university ii grants for IT companies

3.5 Employment structure in other countries

You've learned about employment structure in the UK. Other countries have different structures. This unit gives examples.

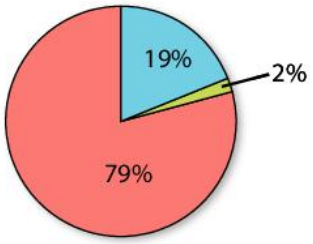


What kind of work?

Imagine you are 18, and already out working. What kind of work do you do? It depends a lot on which country you're in.

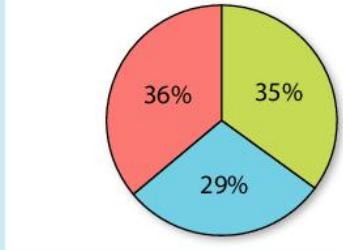
The UK

If you are living in the UK, you will probably be working in the tertiary sector, providing services for people. As you saw, it's the UK's biggest sector.

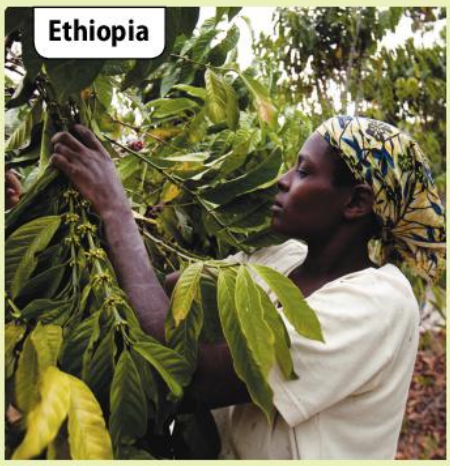


China

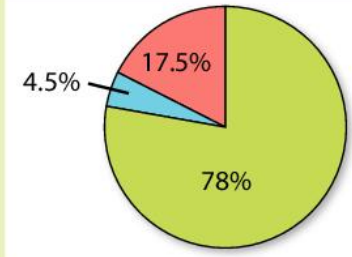
If you're in China, there's a good chance you will be working in the secondary sector, in a factory. Look at the pie chart for China.



Ethiopia



If you're in Ethiopia, you'll probably be in the primary sector, in farming. Perhaps you'll be a coffee farmer. Look at Ethiopia's pie chart.



Structure of employment: primary secondary tertiary

Notice how different those pie charts are.

- China has the biggest secondary slice. It also has the world's biggest working population. It has *over 220 million people* working in factories and construction! It makes more goods than any other country.
- The UK has about 6 million people working in factories and construction.
- In Ethiopia most people work in the primary sector, as farmers. It has about 58 million farmers. That's over 400 times more farmers than in the UK.

How many workers did they have in 2014?

These are approximate numbers:

- UK, 31 million
- China, 770 million
- Ethiopia, 74 million

Different for every country

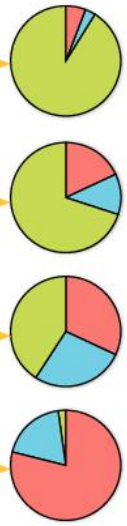
Employment structure is different for every country. And it changes over time, as it did for the UK. Usually like this …

At first, most people farm. They grow their own food, and maybe some to sell. They don't earn much. But over time, farming becomes more efficient.

The country begins to **industrialise**. Factories are set up. People leave farming to work in them. The secondary sector grows. People begin to earn more.

As people earn more, they want more **services**. So the tertiary sector grows. The primary sector keeps shrinking as farming gets more productive.

If cheaper goods are imported from other countries, factories may close. So the secondary sector may start shrinking, as it did in the UK.

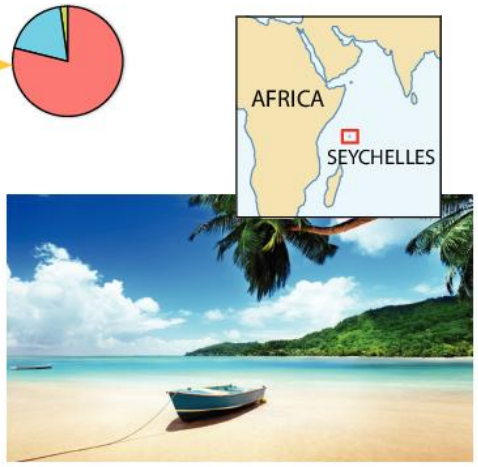


Key
- primary sector
- secondary sector
- tertiary sector

Clues from the pie charts

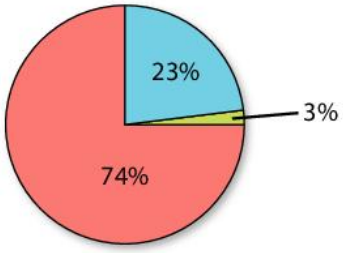
A pie chart for employment structure gives you clues about the country.

- A very big slice for primary, and a much smaller one for tertiary, are clues that a country is not highly **developed**. People may be quite poor, with most people living in rural areas, and few services. Ethiopia is an example.
- Quite a large slice for secondary shows that the country has industrialised. China has industrialised rapidly over the last 25 years.
- A very large slice for tertiary, and a very small one for primary, suggests that the country is highly developed – like the UK and others.



▲ *The Seychelles: waiting for you.*

▼ *Employment structure for the Seychelles.*



But watch out!

Those clues can sometimes lead you astray! Look at the pie chart for the Seychelles, Africa's smallest country. This island nation is *not* highly developed. It has a small primary sector because it doesn't have much farmland. It has a large tertiary sector because it has lots of tourists.

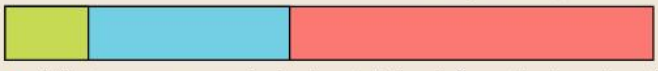
Your turn

1 Look at the pie charts for the three countries on page 56, and the text box in the lower right corner. Which country has:
   - a i the biggest % of workers in the primary sector?
   - ii *most* workers in the primary sector?
   - b Try to explain why the two answers in **a** are different.

2 Of the three countries on page 56, the UK is the most *developed*. See if you can explain the term in italics. The glossary may help.

3 People are starting to set up factories in Ethiopia. Draw a sketch to show how its pie chart might look in the year 2060.

4 You can also show employment structure as a *bar chart*. This one is for Poland. It uses the same colour key as the pie charts.



   - a What can you conclude about Poland, from the bar chart?
   - b Draw bar charts like this one for the UK, and China.

3.6 Where did the UK's factory jobs go?

Lots of factories have closed in the UK, over the years. Why? And where have the jobs gone? Find out here.

Example: textiles and clothing

Once, the UK led the world in **textile** production. It had thousands of factories making all kinds of cloth and clothing. It **exported** textiles everywhere. This photo shows a British clothing factory in 1949.

Today we **import** most of our clothes, sheets, towels, rugs, curtain materials, and other textile goods. From countries like China, India, Bangladesh, Vietnam, Cambodia, and Turkey. This factory is in Cambodia.

It's the same with many other goods: cutlery, saucepans, pens, shoes, combs. And big heavy products like ships, and steel. Once they were all made here, and exported. Now we import most, or all, of them.

So … jobs making these things no longer exist in the UK. They have moved elsewhere.

▲ *Some clothing is still made in the UK – and some factories are doing well. But it's mostly upmarket clothing, and quite expensive.*

Why do jobs move?

Wages are lower in poorer countries. That's the main reason jobs move.

For example, a clothing worker might earn £45 a month in Bangladesh, and £1500 a month in the UK. So Bangladesh can produce clothing much more cheaply than the UK can.

Have a look at this flow chart.

1 A factory in the UK pays high wages, compared to country X.

↓

2 So it has to charge more for its goods, to make a profit.

↓

3 So shoppers choose cheaper goods instead, imported from X. → 6 So X sells more and more goods to the UK.

↓ ↓

4 So the British factory gets fewer and fewer orders. 7 So more factories open in X. More jobs are created.

↓ ↓

5 Eventually it closes down. The workers lose their jobs. 8 The money which X earns helps it to develop.

▲ *One industry in which the UK excels: aerospace.*

▲ *More robots, fewer workers?*

But we still have some manufacturing!

- The manufacturing which left the UK was mostly **labour-intensive**. It needed lots of people. So wage bills were high.
- Much of our manufacturing today is **high-tech**, with highly-skilled workers. In some factories, **robots** do a lot of the work.
- The UK is one of the world's top countries for these two industries:
  - **aerospace** (planes, helicopters, fighter jets, satellites, spacecraft) and
  - **pharmaceuticals** (medical drugs).
- Most people agree that we need more factories. And that it's best to make high-value products that most other countries can't easily make.

Did you know?

- Each year, British companies spend about £12.5 billion on importing clothing.

Who owns the factories in Britain?

Many of the UK's successful factories are owned by foreign companies.

For example, most of the car plants are owned by Japanese, Chinese, Indian, German, and American companies.

But it works the other way too. British companies have opened factories in other countries. For example, some British clothing companies closed their UK factories, and opened new ones in countries with lower wages.

▲ *Cars made in the UK include electric cars like this one.*

Your turn

1 Some time ago, a British company closed its clothing factories in the UK, and opened a big new one in Cambodia, in Asia.
   a Suggest a reason why the company did this.
   b These were all affected by the move:
   the company owners *the factory workers in the UK*
   shoppers in the UK *the factory workers in Cambodia*
   Which of these four groups do you think:
   i benefited from the move? ii lost out?
   Give reasons for your choices.

2 Some factories are not likely to move abroad. For example factories making bread, or ice cream, or frozen pizza. See if you can explain why.

3 Do you agree with what he's saying? Decide, and give your reasons.

3.7 The clothing industry in Bangladesh

Most of the UK's clothing factories have gone. Now our clothes are made in other countries. For example, Bangladesh. Read on …

▲ *Bangladesh is almost surrounded by India. (It was once part of India.) It's smaller than Britain, with 2.5 times more people.*

Everyone needs clothes …

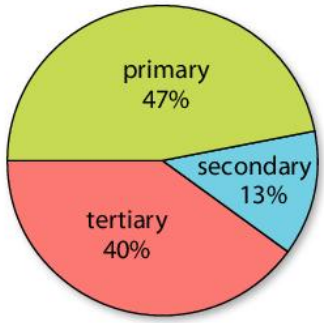
The world has over 7 billion people. And we all need clothes. Year after year!

So when a country begins to industrialise, clothes are a good place to start. Clothing factories can employ lots of people. It's easy to learn how to use the machines.

Bangladesh and clothing

Today, Bangladesh is second in the world for making clothing. (After China.) Most of the clothes stores in the UK get clothing made there.

The clothing industry earns Bangladesh over £14 billion a year, from other countries. That money is helping Bangladesh to develop.



▲ *Employment structure in Bangladesh. The main industry is clothing. There are over 5000 clothing factories.*

Who makes the clothes?

Around 4 million people in Bangladesh work in clothing factories. Most are female. Munna is one of them. She works in Dhaka (the capital city).

Meet Munna

I'm Munna. I'm 18. I've been working here for two years.

My home is about 100 km away, in a village. We have a farm – but not much money. So I had to find work.

I earn about £45 a month. Sometimes I work 7 days a week, 14 hours a day, when there's a big order. So then I get paid overtime. I send home as much as I can.

The trouble is, £45 is not enough to live on. I have to pay rent and buy food. Rents in Dhaka keep rising.

But I can't complain – because I don't want to get sacked!

Why the low pay?

- People in the UK – and other countries – like to buy cheap clothes.
- So the shops want to sell cheap clothes. *And* to make lots of profit. That means getting the clothes made at very low cost.
- So they head for Bangladesh, and negotiate a low price.
- The factory owners want lots of profit too. So they pay their workers the least they can get away with.
- The workers need the money … so they just get on with the job.
- The government does not interfere much. It wants those clothing orders!

Dangerous conditions

The days can be long, hot, and noisy, in Bangladesh's clothing factories. And deadly. Over the years, a number of buildings have collapsed, or caught fire. The worst day of all was 24 April, 2013.

The collapse of the Rana Plaza

On 24 April 2013, at 8.57 in the morning, the Rana Plaza in Savar, a suburb of Dhaka, collapsed.

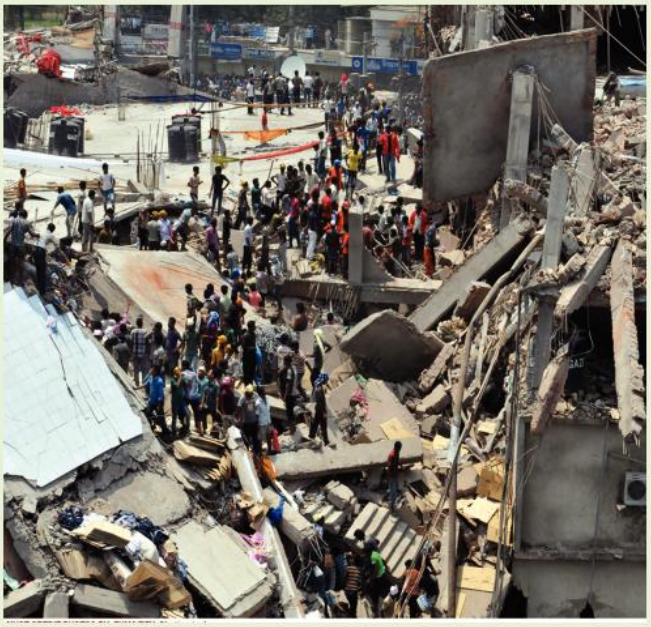
It was an eight-storey building, badly built. The upper floors housed several clothing factories, making clothes for Primark, Matalan, and other companies.

The day before, cracks had appeared in the walls. So a bank and shops on the lower floors had closed.

'It's nothing to worry about', said the owner of the building. 'Come on in' said the factory managers, 'or you'll lose pay'.

So the factory workers went up to their factories. At 8 am, the day's work began. At 8.57 am, the building fell down.

Over 1100 people were killed. Over 2500 were rescued from the rubble. Many of them are maimed for life.



After the Rana Plaza ...

The Rana Plaza disaster shocked everyone.

Primark began to contact the families of the dead, to pay compensation. Other companies were much slower to respond. By a year after the disaster, some injured workers had received nothing.

Clothing stores and brand names will still get clothing made in Bangladesh. But from now on they will inspect factory buildings, and give grants and loans to make them safer. That's good – but sadly, it's too late for some.

▲ *Anna, 16, was trapped for three days in the rubble of the Rana Plaza.*

Your turn

1 Where is Bangladesh? Name the continent it's in, and the countries and ocean which border it. (Page 141?)

2 The clothing industry is very important to Bangladesh. Why?

3 £45 a month is the minimum wage for clothing workers in Bangladesh. That's for 8 hours a day, 6 days a week. How much is this per hour? (Work it out for a year first?)

4 Today, companies like Primark inspect the factory buildings in Bangladesh, before placing orders for clothing. Explain why.

5 Here are three people's opinions. Choose *two* of them, decide whether you agree, and write thoughtful replies.

3.8 Working to bring you a mobile

Workers in many countries – and in all four employment sectors – play a part in bringing you a mobile phone. Find out more here.

The story of your mobile

Let's assume you have a mobile phone. Its story begins at the headquarters of a company – and moves around the world, taking in every sector.

Let's suppose it's an iPhone. Then the story begins at Apple's headquarters in Cupertino, in the state of California, USA.

1 The quaternary sector

At Apple HQ, engineers, designers and programmers work on features for your phone. What would appeal to you? Log in by fingerprint? Voice commands? Pay for things by waving your phone at the till?

After many months of top-secret work, the design is perfected.

2 The primary sector

All the materials that make up your phone come from Earth's crust.

The plastic is made from chemicals in oil. The glass is made from minerals extracted from rock.

And then, the metals. Around *sixty* different metals are used in smartphones. Some familiar ones – like gold, silver, copper, tin – and others you may not have heard of – like indium, cerium, and neodymium.

The metals come from all over the world. Many belong to an important group called the **rare earths**, which are mined mainly in China.

3 The secondary sector

The parts for your mobile are made – but *not* by Apple. (Apple does the design and marketing.) They are made in other people's factories, in several countries. Then the phones are assembled, mostly in China.

4 The tertiary sector

And now, the focus is on you. The phones are in the shops. The staff are ready to sell them to you. You are so tempted!

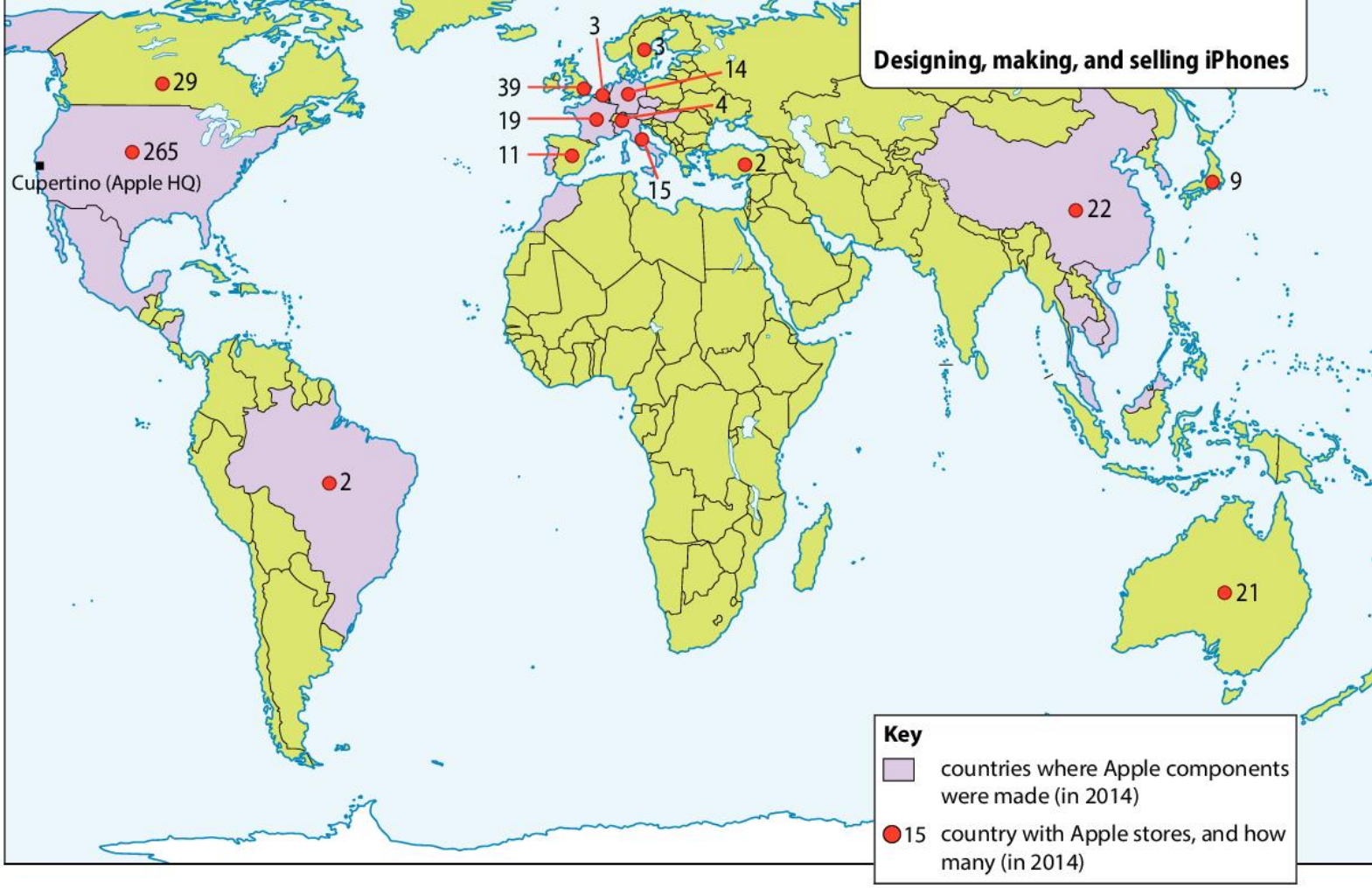
5 The quaternary sector again

You pay for a call plan. You go on the internet, and send texts and images. You download apps and music. All made possible by clever people in the quaternary sector, in many different companies.

▲ *All yours. Earth's resources, processed and neatly packaged, for you to enjoy.*

▲ *A rare earth mine in China. Rare earth metals are used in mobiles, electric cars, wind turbines, and many other products. China controls their export tightly.*

▲ *Getting ready to assemble your phone, in China.*



A global company

Apple has branches all over the world. So it is a **multinational corporation**.

Its business is a good example of **globalisation**. Globalisation means the way the world is becoming more interconnected. It is getting easier to do business anywhere, and move work and goods and money and ideas around.

So … what's your mobile?

Perhaps you don't have an iPhone, or any mobile. But if you do, you can be sure that it's made using Earth's resources, from many places. And assembled in countries where wages are lower than in the UK.

▲ *Queuing outside an Apple store in France. Apple has over 400 stores worldwide.*

Your turn

1 Look at the map above.
- a Which country has most Apple stores? Suggest at least two reasons to explain this.
- b Name three countries where Apple components are made, but which do not yet have an Apple store. (Page 141?)
- c Which European country has most Apple stores?
- d Which inhabited continent has not yet got an Apple store? Suggest a reason.

2 In fact most iPhone parts are made in China, and most assembly is done there. Suggest at least two reasons for this.

3 a What does *globalisation* mean?
- b These help the process of globalisation. See if you can explain the part each plays.

planes

container ships

world wide web

4 International development

The big picture

This chapter is about **development** – the process of change for the better. Here's the big picture …

- Development is about improving people's lives.
- It goes on all over the world, in every country – including the UK.
- Every country is at a different stage of development.
- There is a big development gap between the rich and poor countries.
- The world aims to put an end to extreme poverty by 2030.

Did you know?
- The 85 richest people in the world have more combined wealth than the 3 billion poorest people.

Your goals for this chapter

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

- What conditions might you expect to find in a poorly developed country?
- What are *development indicators*, and which five examples can I give? Include GDP per person (PPP)!
- Overall, on which continent are people poorest?
- Where is Malawi? What can I say about it? (Give at least six facts, including about its level of development.)
- Where is Singapore? What can I say about it? (Again, at least six facts.)
- Some countries are much less developed than others. See if you can give at least six reasons to help explain why.
- What do these terms mean?
  colony *corruption* *cash crop* *commodity* *infrastructure*
- What kinds of things drive people to leave their countries, to try to enter other countries illigally? What kinds of dangers do they face?
- What does *extreme poverty* mean (in terms of dollars)?
- What part can each play in helping to end extreme poverty?
  the poor countries themselves *the richer countries* *individuals like you*
- Manufacturing can play a big part in helping poor countries to develop. Give three reasons to explain why.

Why…
- … are some people so much richer than others?

What if…
- … everyone was equally wealthy?

What if…
- … everyone was equally poor?

Did you know?
- Of the top 10 richest countries (per person), 6 are in Asia.
- Of the top 20 poorest countries, 18 are in Africa.

And then …

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

Your chapter starter

Look at the photo on page 64.

Something new has been brought to this African village. What is it?

Why is everyone looking so happy?

Why didn't they have this thing before?

Do you think there are many people in the world who don't have it?

4.1 Rich world, poor world

This unit is about how unequal our world is.

Comparing lives

You did not choose the country you live in. But it shapes your life. Compare these four young people. They are all aged 15.

Hannah lives in the USA. She plays the trumpet. She has just been to Mexico on a school trip. She gets $30 a week pocket money (about £20). Sometimes she wants to be an engineer, and sometimes a writer.

Kofi lives in Ghana. He's brilliant at maths, and he'd love to be a computer programmer. But his family can't afford to keep him at school any longer. He'll try to get an office job. It would be great to earn £50 a month!

Julien lives in Bolivia. He's a shoeshine boy, and earns about 6p a customer. He lives in the family shack, with no running water. He goes to a study centre in the evenings, to learn to read, and write, and use computers.

Nisha lives in Nepal. She has never been to school. She helps at home, and on the farm, and collects firewood for cooking. She has not seen herself in a mirror for years! (They had a mirror once, but it got broken.)

Not everyone in their countries lives like those four. For example in the USA, many families are much better off than Hannah's, and many much poorer.

But *overall*, people have a much higher **standard of living** in some countries than others. The world is a very unequal place.

What if...

◆ ... you had never seen a mirror?

An unequal world

Of those four teenagers, Hannah has the highest standard of living. She has water on tap, and electricity. A good education. Plenty of food. Money to spend. And many choices ahead of her.

So … do more people live like Hannah – or like Nisha? Think about this:

- The world has over 7.3 billion humans. (That's 7300 million.)
- *Nearly half of us* live in poverty, on less than $2.50 a day. (Less than £1.65.) For food, shelter, clothing, fuel, medicine, everything.
- Around 1 billion of us live in *extreme* poverty, on less than $1.25 a day. (Less than 83p.)
- Around a quarter of us do not have electricity.
- Around 1 in 10 does not have access to clean safe water.
- More than a third of us do not have access to adequate toilets.
- Around 800 million of us do not get enough to eat … ever.
- Around 1 in 7 people aged 15 and over can't read or write.
- Around 22 000 children die every day, from causes linked to poverty.

So that makes Hannah a very lucky person. Are you lucky too?

▲ *Some mums hope their babies will grow up bright and beautiful. Some just hope they'll survive.*

Did you know?

- If the world were a village of 100 people … 26 would be under fifteen years old.

It's all about development

In a **developed** country, almost everyone has enough food, and enough money to survive on. Plus access to electricity, a supply of clean water, education, healthcare, and so on.

There are over 190 countries. Each is at a different stage of development. The USA, and the UK, are among the most developed.

Some countries lag far behind, with over half of their people living in poverty.

In the next unit, we'll look more closely at what development means.

Did you know?

- A single person in the UK, earning £20 000 a year, is in the richest 5% of the world's people.

Your turn

1 a Look at the four teenagers. See if you can put them in order of their *standard of living*, with the highest standard of living first. (Glossary?) Give reasons for the order you chose.
  b Which one do you think has a life most like yours?

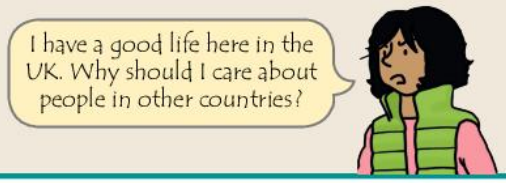
2 Look again at the four teenagers.
  a Can you say which one is the happiest? Explain.
  b Is it possible that Nisha could be the happiest? Give reasons for your answer.

3 a What does *inequality* mean? (Glossary?)
  b From the bullet points above, choose the three you think give the strongest examples of inequality in the world.

4 Billions of people live in poverty, through no fault of their own. This is unfair. It is also dangerous – because *poverty can help to trigger conflict*. See if you can explain why.

5 We humans can put an end to poverty, if we want to. See if you can come up with some suggestions for doing this.

6 Think about what this person has to say. Then write a thoughtful reply. See if you can make several points.



4.2 So what is development?

What does the term 'development' mean? Find out here.

Why...
- ... do women everywhere, on average, earn less than men?

It is many different things

Development is about **improving people's lives**. It is not just about getting richer, or owning more things. It has many aspects.

In a highly developed country ...

In a highly developed country you'd expect to find that ...

- everyone has access to clean safe water, and electricity
- all young people, like you, go to school
- there is no extreme poverty
- people who can't find work, or support themselves, get help from the government (for example, help to pay the rent)
- there are good schools, and clinics, and hospitals
- there are good transport links (roads, railways, airports)
- shops sell a big range of goods, from all over the world
- there's a wide range of other services (like gyms, cinemas, theatres ...)
- everyone is treated equally
- women have as good a chance as men, to earn a living
- the % of workers in farming is low.

▲ *Water for fun.*

In a poorly developed country ...

In a poorly developed country you'd expect to find that ...

- many people have no access to clean safe water, or electricity
- some children go to school for only a year or two – or never
- many people live in extreme poverty, with almost nothing
- you get little or no help from the government, even if you are starving (but a charity migh help you)
- there are not enough schools, or teachers, or hospitals, or doctors
- the birth rate is high
- many roads are just dirt tracks, and railways may be run down and need repair
- shops and markets sell only a limited range of goods
- females usually have less choice than males do (for example, girls may receive less education, and be expected to marry young)
- a high % of people live by farming.

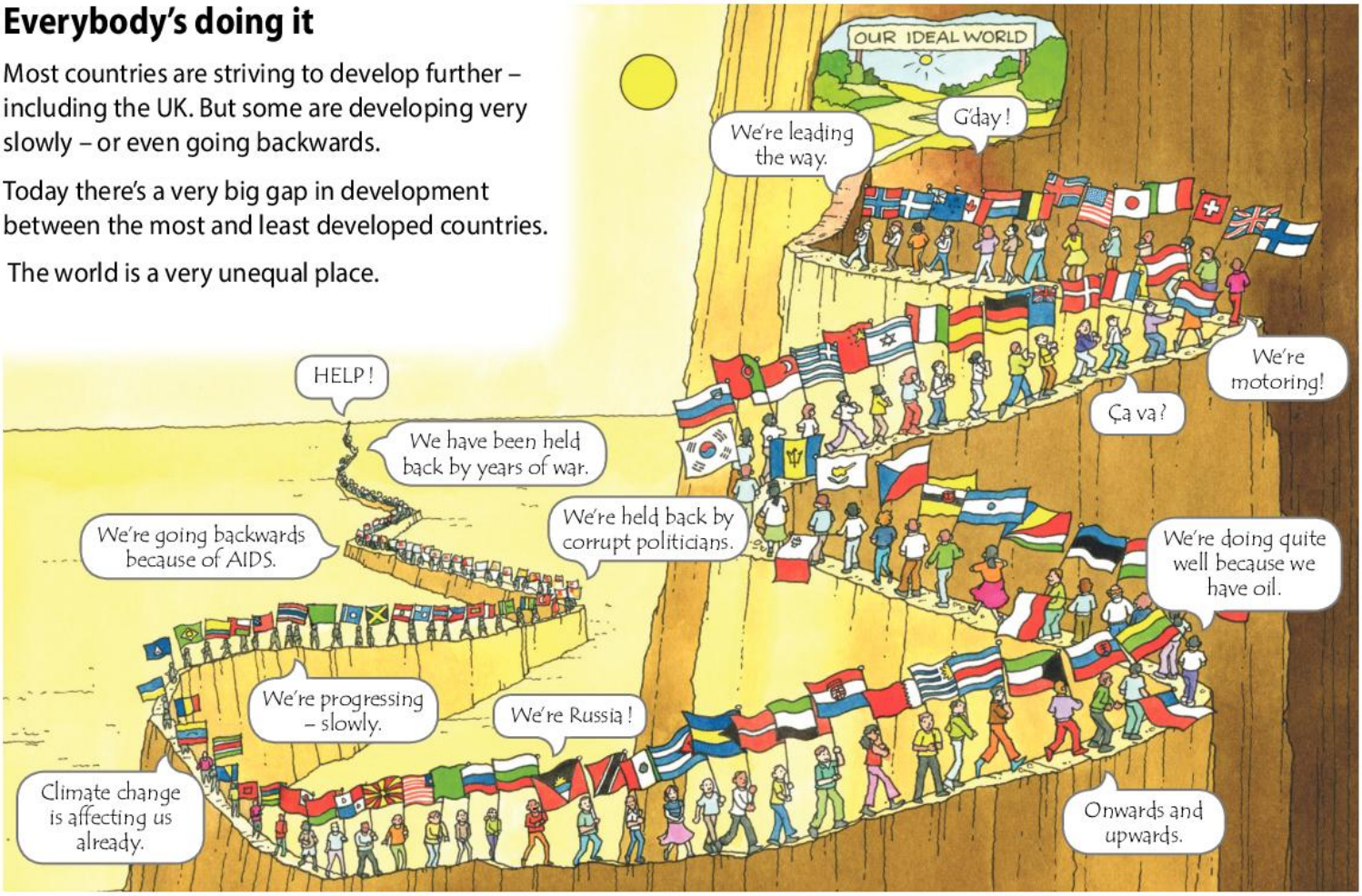
▲ *Water for survival.*

Everybody's doing it

Most countries are striving to develop further – including the UK. But some are developing very slowly – or even going backwards.

Today there's a very big gap in development between the most and least developed countries.

The world is a very unequal place.



▲ *Countries can be put in order of development. The order changes over time. The UK is usually in the top 15.*

Your turn

1 The green panel on page 68 shows conditions you'd expect to find in a highly developed country.
   - a Pick out the four you think are the most important.
   - b i Put your chosen four in what you think is their order of importance, most important first.
   - ii Explain why your first one is the most important.
   - c Now pick out one you did *not* choose for your list. Explain why you think it's less important.

2 Next, look at the blue panel. If you were in charge of a country with these problems, which *two* would you want to tackle first? Give reasons for your choice.

3 Look at the drawing above.
   - a The slope is quite steep. What is that trying to tell us?
   - b Write 45 words to summarise the message in the drawing.

4 The photo on the right was taken in Syria in 2015, after more than three years of civil war.
War can halt a country's development, or even reverse it. Explain why. You could show your answer as a spider map.

5 The UK is striving to develop further. Which aspects do you think we need to do more work on? Write a letter to the Prime Minister giving your list, and reasons.

4.3 Measuring and mapping development

Here you'll see how data is used to measure development, and compare countries.

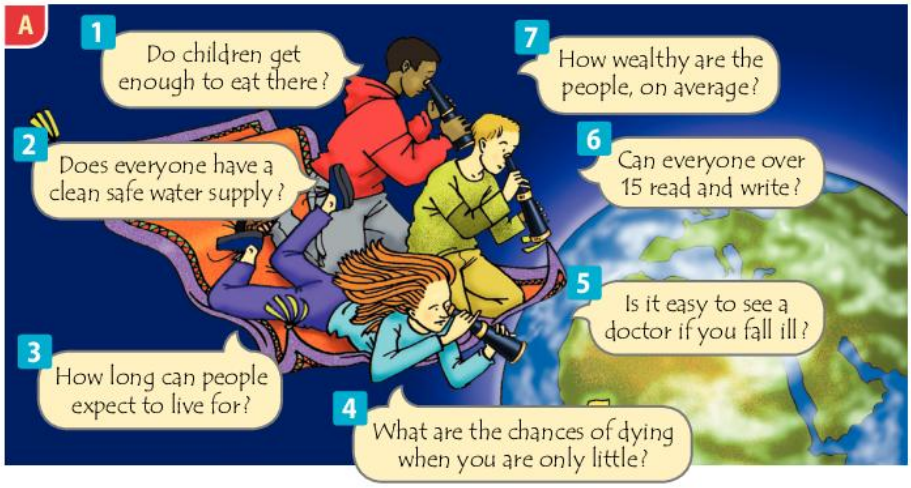
Measuring development

When you visit a country, you can quickly get an idea of how developed it is. Just look around you!

But to *measure* how developed it is, you must ask questions like those on the right, and collect data to answer them.

Data is collected every year, for most countries. It is published in tables of **development indicators.**

A



What is a development indicator?

A **development indicator** helps to tell you how developed a country is.

For example, look at question 3 in the drawing above. It is answered by a development indicator called **life expectancy**.

Life expectancy means how long people can expect to live for, on average. People in poorly developed countries usually have low life expectancy. They may have too little to eat, for example, and no doctors to help them.

B

Some development indicators

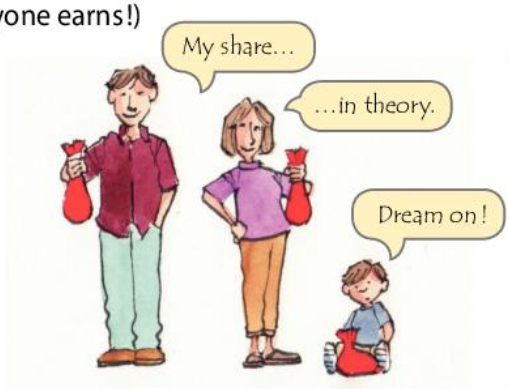
- adult literacy rate (%)
- life expectancy (years)
- % of the population with access to clean safe water
- number of doctors per 10 000 people
- under-5 mortality rate (%)
- GDP per person (PPP) ($)
- % of children under age 5 who are underweight

Wealth as a development indicator

Now look at question 7 in the drawing. It is answered by a development indicator called **GDP per person (PPP)**.

The **GDP** or **gross domestic product** is the total value of the goods and services a country produces in a year. You can think of it as the total amount earned in that country, in a year. (Add up what everyone earns!)

GDP is given in international dollars. **PPP** or *purchasing power parity* means it has been adjusted to take into account that a dollar buys more in some countries than others.



You divide GDP by the population to get the **GDP per person (PPP)**. This lets us compare countries of all sizes fairly, no how many or few people they have.

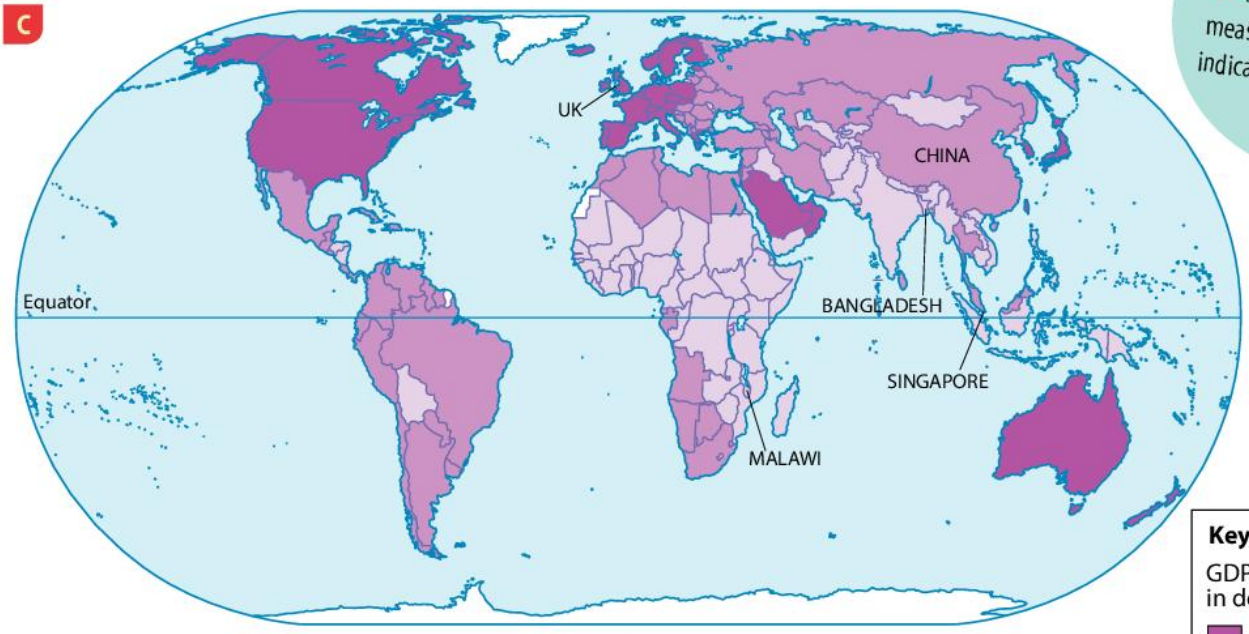
Country	GDP per person (PPP)
Singapore	$78 800
UK	$38 500
China	$11 900
Bangladesh	$2800
Malawi	$780

This table shows GDP per person (PPP) for five countries in 2013. Compare the figures. Singapore is one of the world's wealthiest countries. Malawi is one of the poorest.

A map of GDP per person (PPP)

GDP per person (PPP) is often used as the main indicator of development.
Look how it varied around the world in 2013:

C



Key
GDP per person (PPP) in dollars
- Over 20 000
- 5000 – 20 000
- under 5000
- no data

Did you know?
- Some countries now measure happiness as an indicator of development.

Note that:

- a high GDP per person is usually a sign that a country is developed. It is likely to have good roads, hospitals, schools, and so on.
- countries with a low GDP per person are called **developing countries**. (They will become more developed over time.)

But it's not the full picture

GDP per person tells you how wealthy the people in a country are, *on average*.
In practice, some people could be extremely rich, and the rest very poor.
The rich might spend their money on mansions, not schools or hospitals or roads.

So, for a clear picture of development, it's best to look at other indicators too.

Did you know?
- Like all indicators, 'life expectancy' is an average value.
- It is low in many poor countries – partly because many babies die.

Your turn

1 a Make a table like this, with room for seven questions:

Question	Indicator which answers it
1 Do children get enough to eat there?	
2	

b Fill in the other questions from drawing **A** on page 70.
c Now fill in the development indicators which answer them. You'll need to use list **B**, and perhaps the glossary. Start with the easiest one!

2 In your table, write *H* beside an indicator if its value will be high, for a poorly developed country. Write *L* if it will be low.

3 a Look at map **C** above. Which *continent* has the lowest GDP per person (PPP) overall?
b Name five countries with GDP per person (PPP):
i over $20 000 ii under $5000
c Will the map look the same 40 years from now? Explain your answer.

4 A high GDP per person (PPP) for a country does not mean that *everyone* there is well off. Explain why.

4.4 Malawi: a developing country

Here you can find out more about Malawi, a country which was once a British colony.

Meet Malawi

- Malawi is a long thin country in East Africa.
- It is about half the size of the UK, in area.
- It has around 17 million people. (The UK has 64 million.)
- One of its main physical features is Lake Malawi, which is rich in fish.

A little history

Once, Malawi was part of an empire called the Maravi Empire. The first British person arrived there in 1859. He was Dr Livingstone, a Scottish doctor and missionary. He was followed by other missionaries, and traders.

In 1891 Britain took control of Malawi. British planters set up plantations there, to grow coffee, tea, tobacco, and cotton, for export. But in 1964, after decades of struggle, the country gained independence.

Malawi's economy

- Malawi is one of the world's poorest countries.
- Nearly 90% of its people earn a living by farming.
- Tobacco is its top export. It also exports sugar, tea, and cotton.
- It has few mineral resources (but there may be oil under Lake Malawi).

Some indicators of development

Compare the figures for Malawi and the UK:

Indicator of development	Malawi	UK
GDP per person (PPP)	$780	$38 500
Adult literacy rate	61%	99%
Life expectancy	55 years	81 years

This data indicates that Malawi is a developing country. It does have some wealthy people – but most are poor. Like Sephora, on the next page. Read about her. Then try 'Your turn'.

Did you know?

- Lake Malawi twinkles at night, with light from the lanterns in the fishermen's boats.

Your turn

1. Where is Malawi? Give as much detail as you can, including the names of the countries which border it.
2. For how many years did Britain control Malawi?
3. Look at the data in the table above. How many times richer is a person in the UK, on average, than a person in Malawi? (Division!)
4. How many years longer will a person live, on average, in the UK than in Malawi? Suggest reasons for this difference.
5. Malawi is *landlocked*. (Glossary?) See if you can explain how this may have held back its development.
6. Page 73 gives an account of Sephora's day. Rewrite the account … but for *your* day.

Sephora's day

Sephora lives near the northern end of Lake Malawi. She's nine.

Off to school

It's 6.15 am. Sephora is on her way to school, in her worn dress and bare feet. She sings as she walks along the dirt track. The sun is already bright, and the mountains gleam in the distance.

School starts at 7 am. After outdoor assembly she heads for her classroom, with the other 97 children in her class. There are no desks, so she'll sit on the floor. She has a pencil, but her exercise book is full. Her mum can't afford another one yet. So she won't be able to write anything today.

There are no books to read. Just a blackboard. The teacher does her best. But it's hard to teach 97 children – or even remember their names!

After school

School finishes at 1 pm. Sephora runs home to help on the farm. She will weed the vegetable patch, and look after the hens, and get water from the well. And later, help her mum make the maize porridge they eat every day.

Then it gets dark …

It gets dark around 6 pm. There's a kerosene lamp and a torch. But these don't give much light. So by 7 pm, Sephora is lying on her mat on the mud floor with her little sister, ready for sleep. Her two brothers are in the corner, on their mat. Outside, the dogs bark and the frogs croak.

What will her future be?

Sephora thinks over what her dad said. 'This will be your last year at school, Sephora. You'll stay at home, and the boys will start school.'

She's sad. She longs to complete primary school, and go to secondary school. She knows she learns fast. But now she won't have the chance.

So what will become of her? She'll work on the farm. Then get married at 18, and have her own children. A girl in the village got married last week, at 14! That's illegal now. She hopes her dad wouldn't allow it.

▲ *In Sephora's village.*

▲ *In Malawi's primary schools, the average class size is over 80. (Not enough teachers!)*

▼ *Elephants, hippos, rhinos, monkeys, zebra: Malawi has them all.*

▼ *Lake Malawi: more species of fish than any other lake in the world.*

4.5 Singapore: a developed country

Like Malawi, Singapore was once a British colony. Find out more about it here.

Meet Singapore

- Singapore is an island country off the tip of Malaysia.
- It's very small: less than half the size of Greater London.
- It has nearly 4 million citizens – and 1.6 million other people (including families) there temporarily, for work contracts.
- About three-quarters of its citizens belong to the Chinese ethnic group. Most of the rest are Malay and Indian.

A little history

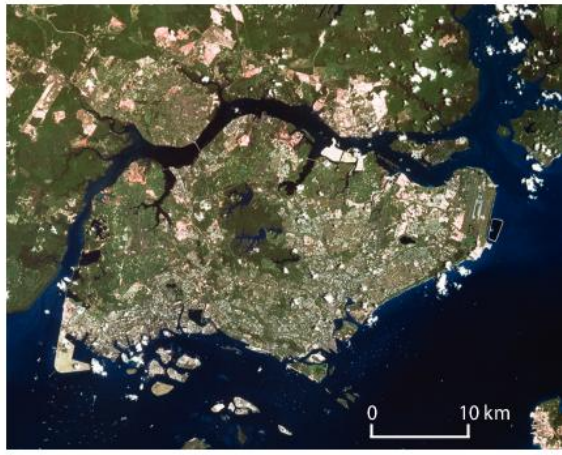
In 1819, Britain signed a treaty with a ruler in Singapore, to set up a British trading post there. Then, stage by stage, the island became a British colony.

During World War II, Japan invaded the island, and destroyed most of it. After the war, Singapore rebuilt itself. In 1965, after years of internal conflict, it became an independent country. (That's a year after Malawi did.)

Singapore's economy

- Singapore is now one of the world's wealthiest countries. But it has some poverty too. Up to 15% of the population are hard up.
- It has very little farmland or other natural resources. Even fresh water is scarce. So it has to buy in almost everything it needs.
- It earns money by importing materials, processing them, and exporting the products. For example it imports oil, and exports chemicals obtained from oil.
- It earns even more as a shipping hub. Cargo is moved from ship to ship at Singapore, depending on final destination. (Like when you change trains at a station.) It has the busiest **transhipment port** in the world.

On the next page you can read about Cheng, whose parents are quite well off. Then try 'Your turn'.



▲ *A satellite image of Singapore.*

▲ *Goods waiting for their next ship, at Singapore port.*

Your turn

1. Where is Singapore? Give as much detail as you can, including the names of the two countries nearest to it.
2. a Having a port has helped Singapore to develop. See if you can explain how.
   b China is the world's top manufacturing country. How does this help Singapore? (See the map at the top of the page.)
3. There are very few farmers in Singapore. Why?
4. In what ways is Cheng's life different from yours? Think of a good way to show your answer.
5. There is *relative poverty* in Singapore. But there is *absolute poverty* in Malawi. Explain the difference. (Glossary?)
6. Now draw a spider diagram to sum up what you have learned about Singapore. You could include the headings *Physical geography* and *Human geography*. (Glossary?)

Cheng's day

Cheng's family are citizens of Singapore. Cheng is fifteen.

Off to school

Cheng leaves the apartment on the 12th floor, and walks to the lift. His mum and dad have gone to work already. He's wearing his school uniform – blue shirt and trousers – which Yuli, the Indonesian maid, has ironed for him.

It is just ten minutes' walk to school, so he'll be there for 8.30 am.

He likes Tuesdays. He has science and maths, and Chinese (Mandarin). Best of all, he has photography. Apart from Mandarin class, everything is in English.

He works hard at school. Twice a week, after school, he has private tuition. And on top of that, homework – around ten hours a week!

After school

Today, two of Cheng's friends will come home with him. They'll swim in the apartment block's swimming pool. Yuli will make them a snack. And then they'll start on homework. They often do homework together.

Cheng's dad and mum usually arrive home around 6.30 pm. At 7.30, Yuli serves dinner. After dinner Cheng will go on his computer.

Tomorrow is Saturday. So he'll play basketball with his club in the morning, and then hang out with his friends.

What will his future be?

Cheng will do O-levels, then A-levels. He wants to go to university.

He'd like to be an engineer, and design underwater vehicles. Perhaps he'll study in the USA. His dad will pay. But he'll come back to Singapore to settle down. His parents would be so upset if he didn't!

▲ *A special assembly at Cheng's school. Education is a top priority, in Singapore.*

▶ *There's not much land in Singapore. So lots of people – like Cheng's family – live in high-rise apartments.*

▼ *A view of Singapore.*

▼ *Not so well off: he collects things to sell to a recycling centre.*

4.6 How did the development gap grow? – part 1

Why are some countries much more developed than others? This unit gives some reasons.

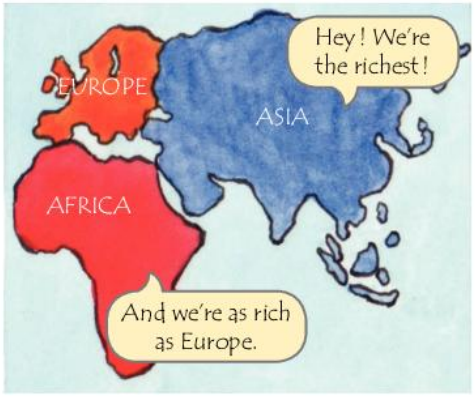
The development gap

As you saw, some countries are much wealthier and more developed than others. Why? In this unit and the next, we look at some reasons.

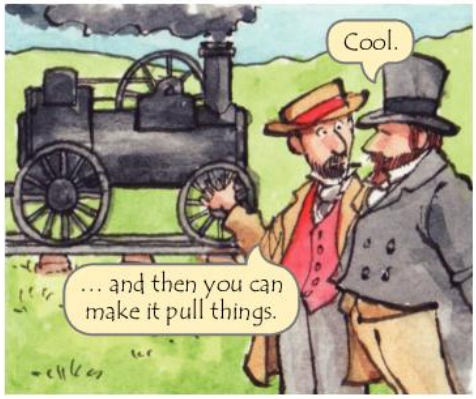
What if...

◆ ... the UK was one of the world's poorest countries?

1 Historical reasons



Think about this! 1000 years ago, Asia was the richest continent, overall. And people in Europe and Africa had a similar level of wealth.

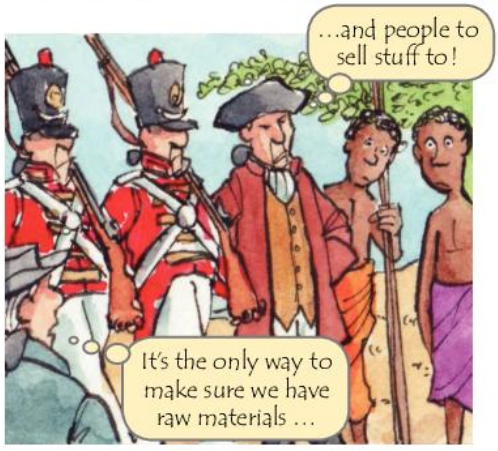


But things change. And by 1750, the **Industrial Revolution** had begun in Britain. It spread, and Europe leaped ahead in wealth and development.

Europeans had already settled in North America. So industries began to develop there too – and North America began to grow wealthy.

Meanwhile, Europeans had been exploring Africa, South America, and Asia. They had found lands rich in natural resources. Trading soon followed.

The Europeans traded for things like gold, ivory, tobacco, spices – and in some places, slaves. But as time went by they grew greedier ...



... and took over places as **colonies**. So now they were in control. And the materials and slaves they shipped out made many Europeans very rich!

Eventually, the colonies won their independence. But most were left with few roads, schools, hospitals, or skills ... and much unrest.

Overall, several European countries – including Britain – grew richer and more developed by exploiting colonies. But they did little to develop their colonies. Many ex-colonies, such a Malawi, are still very poor today. Some are still unstable. (But some, like Singapore, are doing fine.)

2 Geographical reasons

A country's location, and climate, and natural resources, can play a big part in helping it to develop.

In a hot dry landlocked country, with poor soil and few other natural resources, development may be very difficult.

But some countries have rich soil, and a climate that helps farming. And natural resources – such as oil – that other countries are keen to buy.

Some countries benefit greatly from their location. Singapore – as you saw – is an example. It sits in one of world's busiest shipping routes.

3 Health and education

A well-educated, skilled, and healthy workforce helps a country to develop. People can come up with bright ideas, and work together to tackle problems. But poor countries are at a disadvantage.

Poor countries have lots of bright young people. But many don't get a good education. (There aren't enough trained teachers, for one thing.)

Diseases such as malaria, TB and AIDS are common in many poor countries. If you are unwell, and undernourished, you can't work.

If you are poor, most of your energy will go into finding food, and water, and firewood. You won't be able to think about much else.

Your turn

1 **A – D** are facts about some different countries. For each, explain how this could have held back development.
   - **A** It is hemmed in by mountains, and hard to reach.
   - **B** A tribal war has been going on there for 10 years.
   - **C** Millions of its people are suffering from AIDS.
   - **D** The colonisers built only a few roads and schools.

2 Of the four conditions described in **1**, which do you think could be put right, or at least improved, to help that country develop? Explain your choice.

3 The UK is among the world's most developed countries. Using ideas in this unit, see if you give five reasons to explain why. (Don't forget geographical reasons.)

4.7 How did the development gap grow? – part 2

Here we give more reasons to explain why poor countries find it hard to escape from poverty.

Why...
- ... do we still go to war?

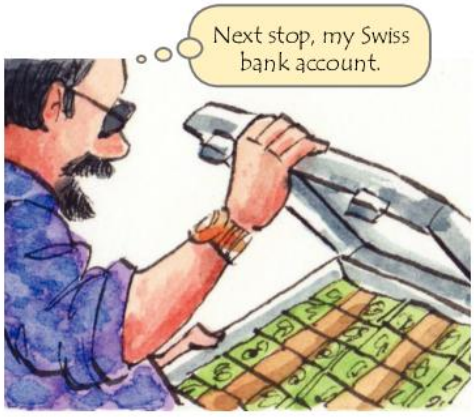
Keeping the gap wide

In Unit 4.6, you met some reasons for the development gap between countries. Now let's look at other things that help to keep poor countries poor.

4 Conflict and corruption

A country has a better chance of developing if it is at peace, with a stable and wise government, and a strong and fair legal system.

But many poor countries do not have stable governments. Many are deep in **conflict**, with a big waste of life – and money.



In many countries, **corruption** adds to the problem. Leaders and officials take bribes, and steal money that should be spent on the poor.

There is some corruption in every country. But it is widespread in some of the poorer countries, and has a big impact on development.

5 Relying on a few exports

Usually, countries earn money by selling things to other countries.

Many poor countries rely heavily on selling just one or two **cash crops** to other countries, to earn money. But that's risky ...

... because the amount they earn for a crop can tumble. For example, if other countries decide to grow lots of it too. Or if ...

... the demand for the crop falls. For example, tobacco is Malawi's main cash crop. As people give up smoking, the demand for tobacco will fall.

It's not just crops. The same is true of other **commodities** too – like metals, and even oil. Their prices can fall. So it's risky to rely on just one or two things.

6 Lack of industry

You can usually earn more by selling factory goods than crops and raw materials. For example, suppose your country grows cocoa.

You can sell your cocoa on the world market. Chocolate companies in richer countries will buy it to make chocolate.

The chocolate companies like to buy cocoa cheaply, if they can. But they charge quite a lot for chocolate – and can charge more every year.

So their profits rise, while your earnings may fall. How nice it would be to make your own chocolate, and export it!

But it costs a lot to set up factories. Poor countries may not have the money or expertise to get started. Even if they do, the electricity supply may fail. Or poor roads may make transport difficult. So it's hard to run a factory efficiently.

Meanwhile the richer countries make a profit by processing commodities from the poorer countries. By processing them they **add value**, and get even richer.

▲ *A cocoa farmer in Ghana. Those yellow pods contain cocoa beans, which are used to make chocolate.*

▲ *When you buy chocolate, the cocoa farmer will have received only a small fraction of what you pay.*

Your turn

1 Explain what these terms mean. (Glossary?)
- a corruption
- b cash crop
- c commodities
- d add value

2 See if you can explain why:
- a corruption holds back development, in poor countries
- b it's risky to depend heavily on tobacco as an export

3 Setting up chocolate factories could help a cocoa-growing country to develop. Explain why. You could draw a flow chart.

4 Poor infrastructure helps to keep a country in poverty.
- a What is *infrastructure*? (Glossary.)
- b See if you can explain how poor roads can hold back development. In 40 words!

4.8 Escaping from poverty

Many people set off on dangerous journeys, to try to escape poverty. You can read about some of those journeys here.

Seydou's story

It's four months since I said goodbye to mum and dad in Mali. I miss them so much. But here I am, in a migrant centre in Lampedusa.

I thought it was a great idea to come to Europe. I'm 17, and I can work really hard. I need to earn money, to help my family like I promised. But I didn't know the journey would be so tough, or that I'd see such terrible things.

My land journey

I went to Tamanrasset first, in Algeria. I got work with builders there, to earn money for the next stage. Then to Sebha, and more work. I got beaten up in Sebha, and had money stolen. So when I got to Zuwara, I had to work for a whole month. The people smuggler charged a lot. He made me hide in the dark for two days, in a store room with over 100 other people, till he was ready to pick us up.

My sea journey

The boat was packed. Babies crying, people sea-sick, people praying. Water started coming in. We kept bailing it out. When we got near Lampedusa we saw the rescue boat. People stood up on that side, and waved and shouted. The boat tipped. It nearly capsized. People fell out – maybe eight or nine. Two were children. None could swim.

Where next?

I 'm lucky I got this far. But I am scared. Will they let me stay in Europe, or try to send me back to Mali ? Mum and dad must be worried sick about me. And they need me to send money. My family is so poor. They have hardly enough to eat.

▲ *Seydou's route – over 3000 km, from Mali to Italy.*

A

▲ *He took what transport he could afford.*

B

◀ *Migrants saved by an Italian rescue boat. It will take them to the Italian island of Lampedusa.*

▼ *A protest in London.*

C

Seydou was not alone

- At least 250 000 migrants crossed the Mediterranean from North Africa to Europe in 2014. At least 3500 died on the way, most by drowning.
- In the first 18 weeks of 2015, over 60 000 crossed, and 1800 drowned.

Why do they do it?

- Like Seydou, many people make the journey across the Mediterranean to escape poverty, and help their families.
- Many others are fleeing from conflict in North Africa, and the Middle East. For example, from Syria. (Page 135.)
- All know they risk their lives – but they feel they have no option.
- All face an uncertain future. They have no visas or permits. Will they be allowed to stay in Europe? Or be forced to return home – or hide?

It's not just the Mediterranean

- All over the world, as you read this, thousands of people are risking everything, without visa or permit, to make a better life in another country.
- For example, many are trying to cross the border from Mexico to the USA. (Look at the map on page 140.) Some will perish in the deserts of Arizona and Texas. Some will be arrested by border patrols.
- In Asia too, people try to reach wealthier Asian countries – or Australia.

The big dilemma

People's dream of making a better life is causing a big dilemma.

- Some people say the migrants must be sent home again – unless they are refugees from war zones, whose lives are truly in danger.
- Others say we must show compassion to all the migrants. We don't choose where we are born. Rich countries can afford to take some migrants in.
- In fact, less well-off countries do much more than the richer countries. Many African countries have huge numbers of refugees. In Asia, Turkey isn't so wealthy. It had almost 2 million refugees in 2015. Most were from Syria.

One way to solve the problem is to help poorer countries out of poverty. Then people wouldn't need to escape. But how? Find out in the next unit.

▲ *The USA built a wall along part of its border with Mexico, to stop migrants entering illegally. Now they try more dangerous routes.*

▲ *Water and food left in the Arizona desert, for Mexican migrants. (Several hundred die of thirst and heat stroke every year.)*

▲ *A protest in the USA about policy towards migrants entering illegally from Mexico.*

Your turn

1 a Why did Seydou make this journey?
b His journey took a few months. Why did it take so long?

2 a Seydou's boat sailed from Zuwara to Lampedusa. Which countries do those two places belong to?
b Both are key places on migrant routes from Africa. See if you can explain why. Page 141 may help.

3 a Explain these terms. (Glossary ?)
i *migrant* ii *economic migrant*
iii *refugee* iv *trying to enter a country without a permit*
b To which groups in **a** does Seydou belong?

4 a Look at photo **F**. Work out what the message on the placard really means. Then rewrite it in your own words.
b Now do the same for photo **C**. It's more of a challenge!

4.9 Putting an end to poverty

This unit is about ways to end world poverty.

Did you know?
- The world has enough money and know-how to end poverty.

Did you know?
- The world aims to end extreme poverty by 2030. (That's not far off.)

The big challenge

As you saw in Unit 1.1, billions of humans live in poverty, many without access to clean water, or electricity, or adequate toilets, or enough food. Around one billion live in *extreme* poverty, surviving from day to day on almost nothing.

Does it have to be this way? No! So what can be done?

1 Poorer countries can help themselves

A

Poorer countries can try new crops, and exploit more of their natural resources, to earn more. For example, they could develop tourism.

B

They can root out corruption. And build more schools, and hospitals, and roads, and other infrastructure. They can educate and train people.

C

They can develop manufacturing. Factories can provide steady work, and a steady wage. People learn new skills. The goods can be exported.

But all this takes money. That's where richer countries come in.

2 Richer countries can help them

Richer countries can help poorer countries by giving them **aid**.

D

Richer countries give aid in the form of grants, or cheap loans, or help and expertise for big projects like roads and railways.

E

Even China, which is not yet highly developed, gives a great deal of aid. China has built roads, hospitals, universities, and much else in Africa.

F

Poorer countries say trade can help even more than aid: we should buy the crops and other goods they produce, and pay them fair prices.

Richer countries have promised 0.7 % of the wealth they produce each year, as aid to poorer countries. (But most give less than they promised.)

3 Help from people like you

G

You help development a little, when you give money to reliable **NGOs** or charities. They may use it for small local projects in poorer countries.

H

For example, to provide materials for villagers to dig a well, so that they have clean safe water to drink and cook with (not dirty river water).

I

Or to give people small loans, to help them set up in business. That's called **microfinancing**. This lady got a loan to buy a sewing machine.

Small projects like these can transform people's lives. Every little helps!

4 Help from technology

Mobile phones are also transforming lives in poor countries. Farmers can arrange transport for crops, for example, or find out where the best prices are. No electricity? No problem. Use a solar-powered charger.

Even better, you can transfer money by mobile. You go to an agent and pay money into your mobile account. Then text a code to the person you want to pay. He or she takes the code to an agent, and gets cash in return. This brilliant idea began in Kenya, and is helping many thousands of Africans.

J

▲ *At the agent's office, with a code to pick up cash. There are agents all over Kenya. No need for a bank account!*

A little more about manufacturing

Manufacturing can play a big part in helping a poor country to develop.

Foreign companies often set up the factories. Not through kindness, but because wages are low in poor countries – so they make more profit. But if they do pay fair wages to their workers, this will help development.

Your turn

1 Look at photo **A**. How can tourism help a country to reduce poverty? You could give your answer as a flow chart.

2 a What is an *NGO*? (Glossary?)
b See how many NGOs you can name.

3 Look at the text below photo **A**. You could summarise it as: *Exploit natural resources.*
Summarise the text under each photo **B** – **I** in the same way, in not more than seven words (written down).

4 Choose any *two* photos from these: **B**, **C**, **G**, **I**.
For each, explain how the action(s) you summarised in **3** can help to lift people out of poverty.

5 Think about his opinion. Do you agree with it? Write him a thoughtful reply.

5 Our restless planet

The big picture

This chapter is about Earth's plates, and earthquakes, and volcanoes.
Here's the big picture …

- Earth is not a solid ball. It is made of hard rock, hot soft rock that's runny in places, molten metals, and solid metals.
- Earth's hard outer layer is cracked into enormous slabs called **plates**.
- These plates are always moving – very slowly – dragged by currents of hot soft rock below them.
- Their movement leads to earthquakes, and volcanic eruptions. These can kill.

Did you know?
- As you sit there, on your chair, you are moving very slowly eastwards – at about 1 cm a year!

Did you know?
- China's deadliest earthquake was in 1556, in Shaanxi.
- It's said to have killed 830 000 people.

Did you know?
- In 1943, a volcano suddenly appeared in a field in Paricutin in Mexico.
- It erupted non-stop for nine years.

Your goals for this chapter

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

- What are Earth's plates, and why do they move?
- What do these terms mean?
  crust *mantle* *core* *lithosphere* *convection current* *oceanic crust* *continental crust*
- What causes earthquakes? And what kind of damage do they do?
- What do these terms mean?
  fault *focus* *epicentre* *seismic wave* *aftershock* *tsunami*
- What causes tsunami? And what kind of damage do they do?
- What are volcanoes? What kind of damage do eruptions do?
- What do these terms mean?
  magma *lava* *crater* *pyroclastic flow* *mudflow* *ash*
- Why do people live near plate edges, even though these are danger zones?

Why…
- … are there no active volcanoes in the UK?

Why…
- … does the UK have remains of volcanoes?

And then …

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

Your chapter starter

Look at the photo on page 84. What's that black stuff flowing along the road?

Where did it come from?

It's hot. What do you think it will be like when it cools?

Do you think it's dangerous stuff? Give reasons.

Was this photo taken in the UK? Yes? No? Maybe? Explain.

5.1 A slice through Earth

You know quite a lot about the outside of Earth, where you live. But what's it like inside? Find out in this unit.

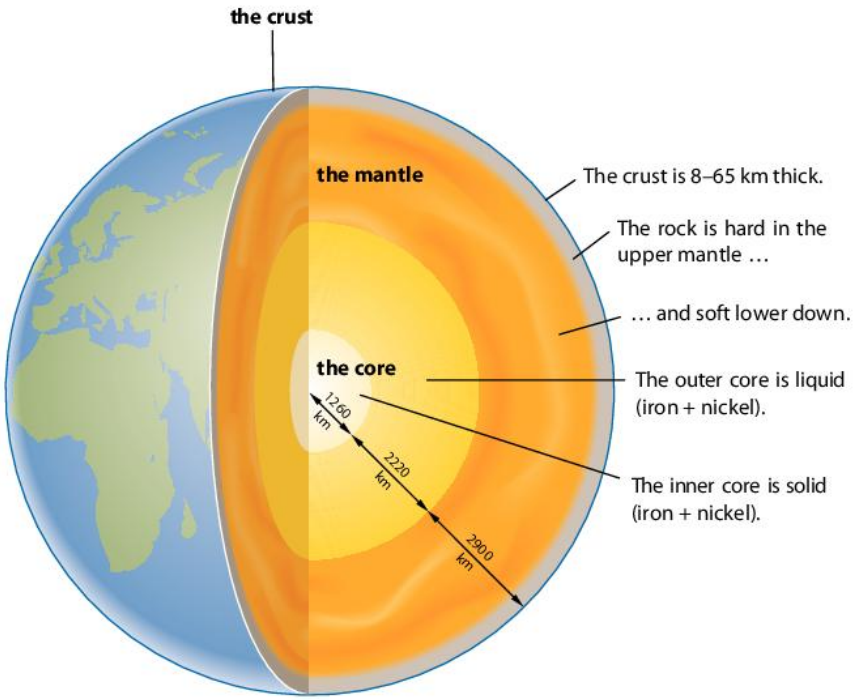
Earth's three layers

Earth is not a solid ball. It's made up of three layers:

1 The crust
It is Earth's hard skin of rock. You live on it. Under the UK, the crust is up to 35 km thick.

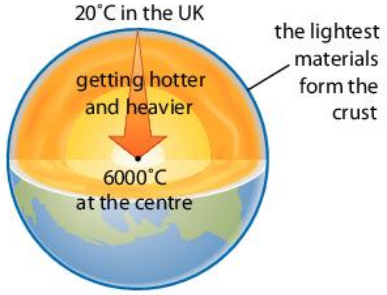
2 The mantle
It's about 2900 km thick. (Or about three times the length of Britain!) It is made of heavier rock.
The upper mantle is hard. But below it there's hot soft rock, like soft toffee. It is runny in places.

3 The core
It is made of metal – mainly iron, mixed with nickel. The **inner core** is solid. The **outer core** is liquid.



How did the layers form?

Some time after Earth formed, it got so hot that everything inside it melted. The heavier substances in the liquid sank, and the lighter ones rose, making layers. As Earth cooled, some layers hardened – but not all.



Hot hot hot

It's still very hot inside Earth. It gets hotter as you go down through it. 200 km down, the rocks are glowing white hot. The temperature at the centre is estimated to be around 6000 °C.

▼ *Boiling rock reaches Earth's surface in many places. This is the Erta Ale lava lake in Ethiopia.*

▼ *Beneath this tower, on the Kola Peninsula in Russia, is the deepest hole ever drilled into Earth's crust – over 12 km deep!*

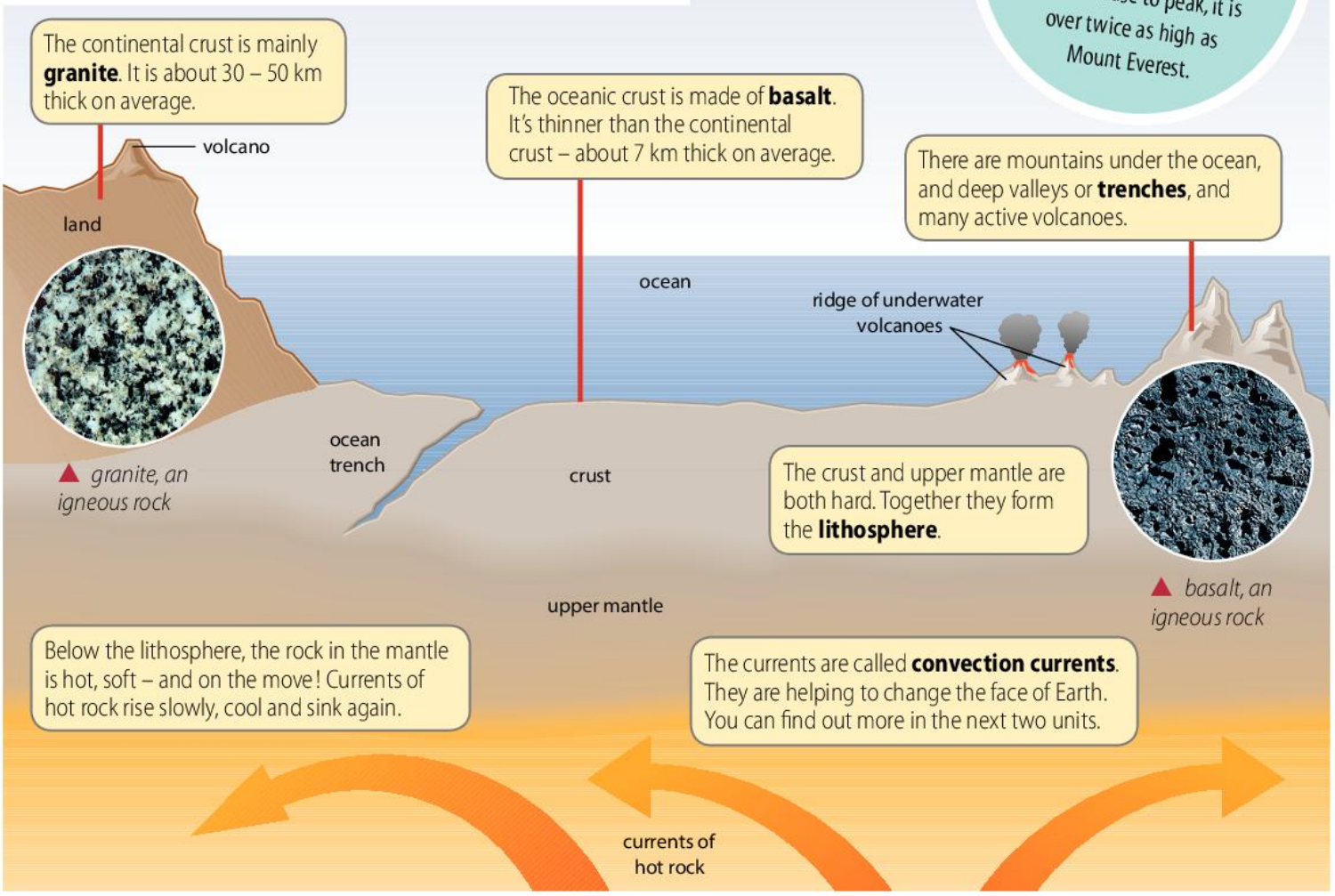
More about the crust and mantle

This drawing shows part of the crust and mantle.

The crust under the oceans is called the **oceanic crust**.
The crust that forms the land is called the **continental crust**.
The rock in the oceanic crust is heavier.

Did you know?

- The tallest mountain on the ocean floor is Mauna Kea in Hawaii.
- From base to peak, it is over twice as high as Mount Everest.



Your turn

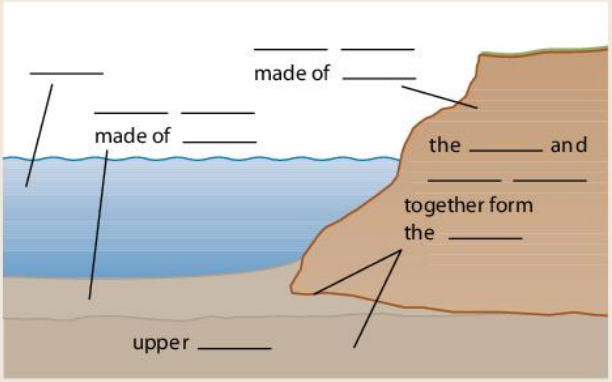
1 Make a table like this, and fill it in for Earth's layers.

Layer	Made of ...	Solid or liquid?	How thick?
crust			
mantle			
core – outer – inner			

2 a What is Earth's radius, in km, at the thickest part of the crust?

b If you cycle at 20 km an hour, how long will it take you to cycle to the centre of Earth?

3 Make a larger drawing like this, and complete the labels.



5.2 Our cracked Earth

The outer part of Earth is cracked into huge slabs. Their movements cause earthquakes and volcanic eruptions. Find out more here.

First, a puzzling pattern

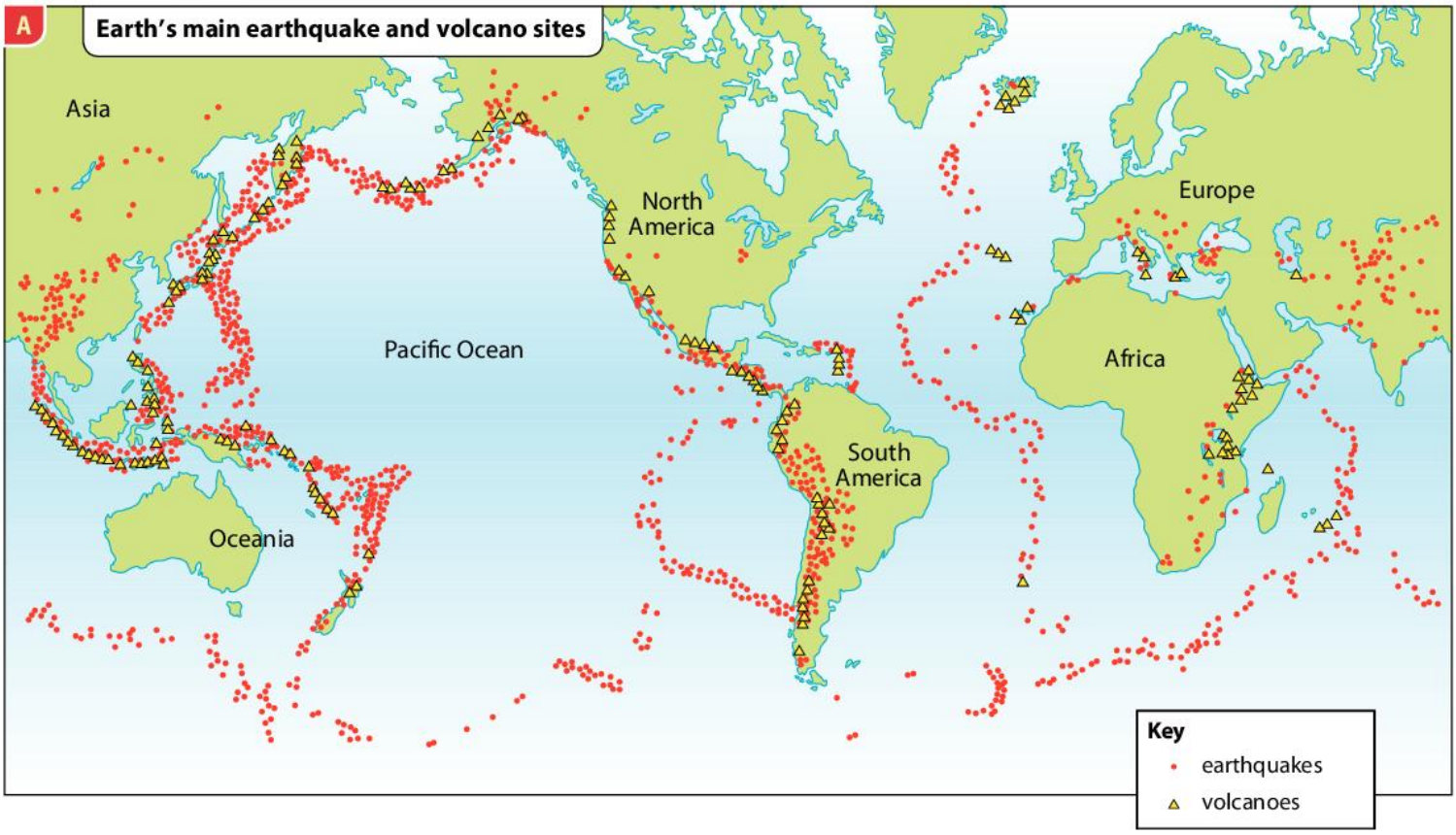
An **earthquake** is caused by rock suddenly shifting.
A **volcano** forms when liquid rock bursts out through Earth's hard surface.

Map **A** below shows Earth's main earthquake and volcano sites. (There are lots of underwater volcanoes too, which are not shown.) Do you notice any patterns?

Did you know?

- The ring of volcanoes around the Pacific Ocean is known as the Ring of Fire.

A **Earth's main earthquake and volcano sites**



As you can see, the earthquake and volcano sites:

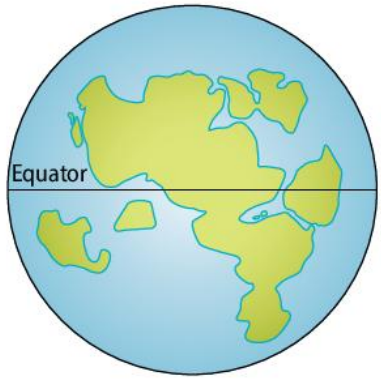
- tend to lie along lines
- are often together
- occur in the ocean as well as on land.

Explaining the pattern

The pattern puzzled scientists for years. Then they found the explanation:

- Earth's hard outer layer is broken into big slabs.
- These slabs are always moving: pushing into each other, pulling away from each other, and scraping past each other.
- This movement causes earthquakes and volcanic eruptions along slab edges.

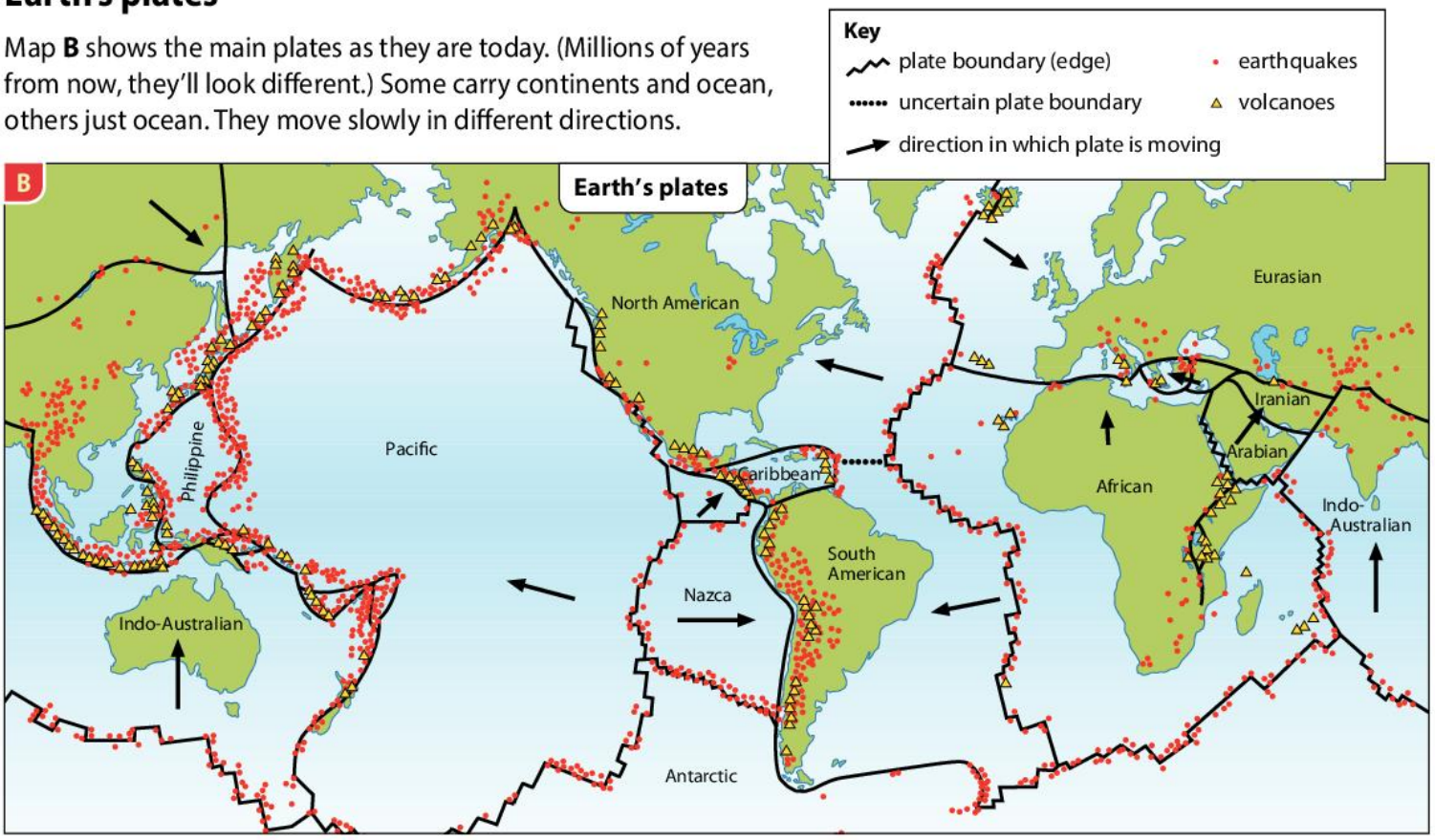
They called the big slabs **plates**.



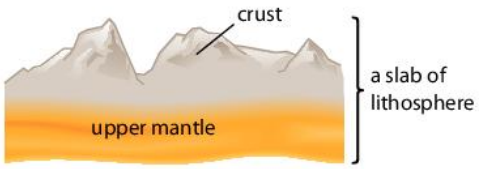
▲ *Earth's plates have been moving, joining, and breaking up for billions of years. One billion years ago, Earth may have looked something like this. (See Unit 1.5 for more.)*

Earth's plates

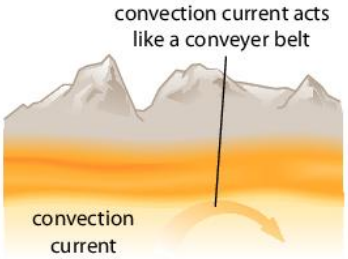
Map **B** shows the main plates as they are today. (Millions of years from now, they'll look different.) Some carry continents and ocean, others just ocean. They move slowly in different directions.



Why do they move?



Plates are slabs of the **lithosphere** – Earth's hard crust and upper mantle. They float on the soft hot rock below. They move because they're dragged …



… by the powerful hot currents – **convection currents** – in the soft hot rock. (Other factors play a part too. Scientists are still researching these.)

They move just a few cm a year – but it all adds up! For example India has moved 2000 km north in the last 70 million years.

Your turn

1 What is: **a** an earthquake? **b** a volcano? **c** a plate? (Check the glossary?)

2 Name:
- **a** the plate you live on
- **b** a plate that is moving away from yours
- **c** a plate that is moving north
- **d** a plate that carries just ocean
- **e** the plate off the west coast of South America
- **f** the plate circled by the Ring of Fire (search page 88)

3 Do your own drawing to show what Earth's plates are made of, and why they move. Give it a snappy title!

4 The sites of earthquakes and volcanoes form a pattern around Earth. Using the idea of plates, explain why.

5 The UK has no active volcanoes today. Give a reason.

6 Suppose our plate starts moving south at 5 cm a year. About how long will it take for Newcastle to reach the Equator? (It's now about 55° N. A move of 1° south equals 440 km.)

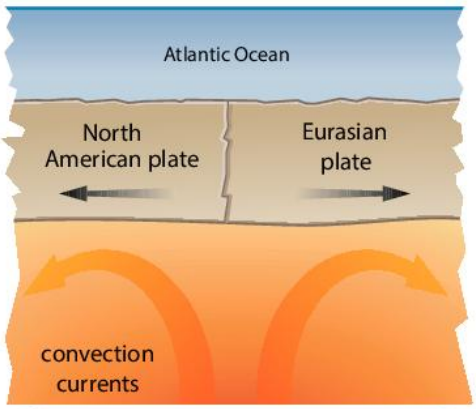
5.3 A closer look at plate movements

Here you'll learn how plate movements lead to earthquakes, volcanic eruptions, and even mountain building!

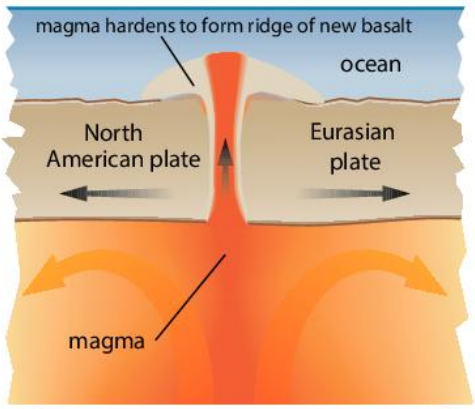
Did you know?
- London moves 2 cm further from New York every year …
- … because of plate movements.

1 Some plates are moving apart

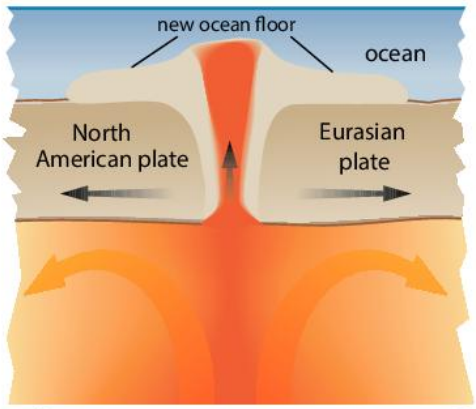
For example our plate and the North American plate are moving apart, under the Atlantic Ocean. (Look at the map on page 89.)



1 The heavy plates are being pulled apart with the help of convection currents in the soft rock below them.



2 Liquid rock or **magma** rises to fill the gap, through underwater volcanoes. It hardens to basalt.



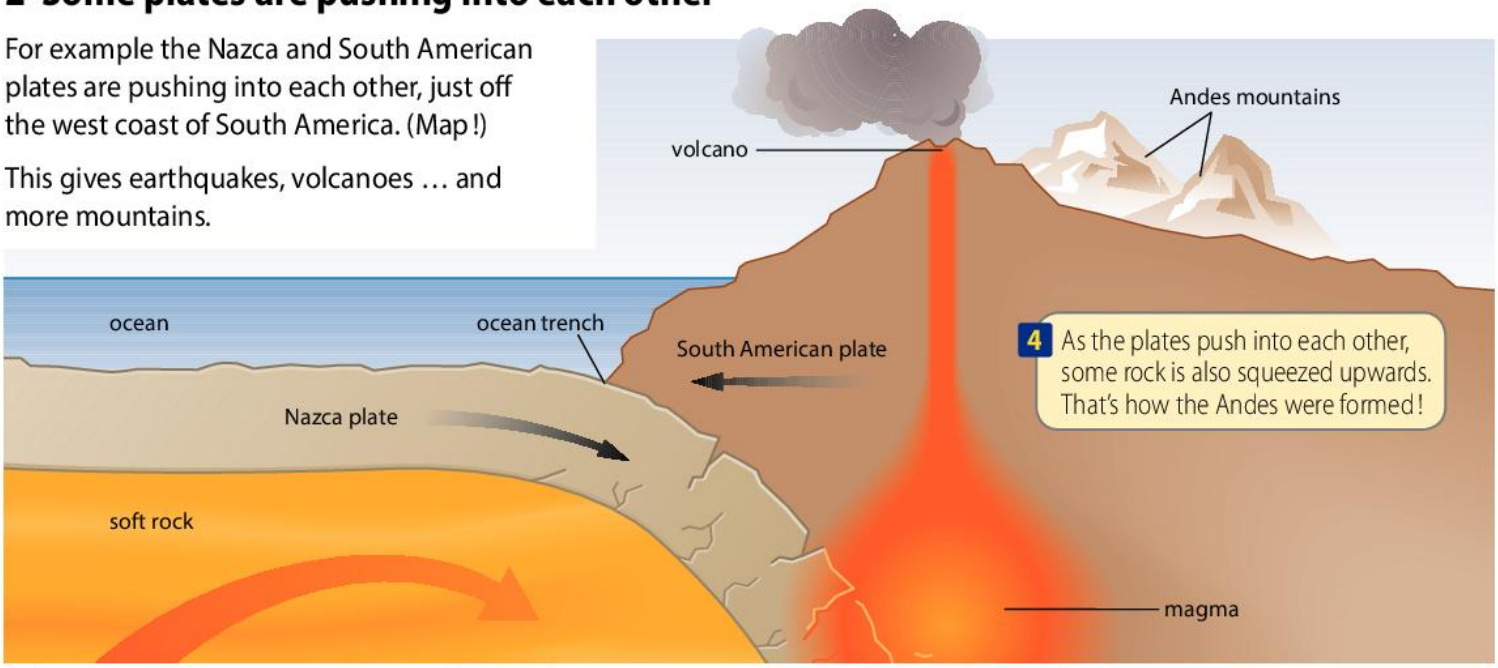
3 As the plates move apart, the floor of the Atlantic Ocean is getting wider – by about 2 cm a year.

Over time, the volcanoes grow into mountains. Long ridges of mountains form under the water. The plate movements also cause earthquakes. So where plates move apart under the ocean, you get earthquakes, and mountain ridges.

2 Some plates are pushing into each other

For example the Nazca and South American plates are pushing into each other, just off the west coast of South America. (Map!)

This gives earthquakes, volcanoes … and more mountains.



4 As the plates push into each other, some rock is also squeezed upwards. That's how the Andes were formed!

1 The Nazca plate is heavier. (Oceanic crust is heavier.) So it gets pulled down by gravity at an **ocean trench**.

2 The rock grinds its way downwards, causing earthquakes. At the same time …

3 … it heats up. Some rock melts, and forces its way up through the Andes to form a volcano.

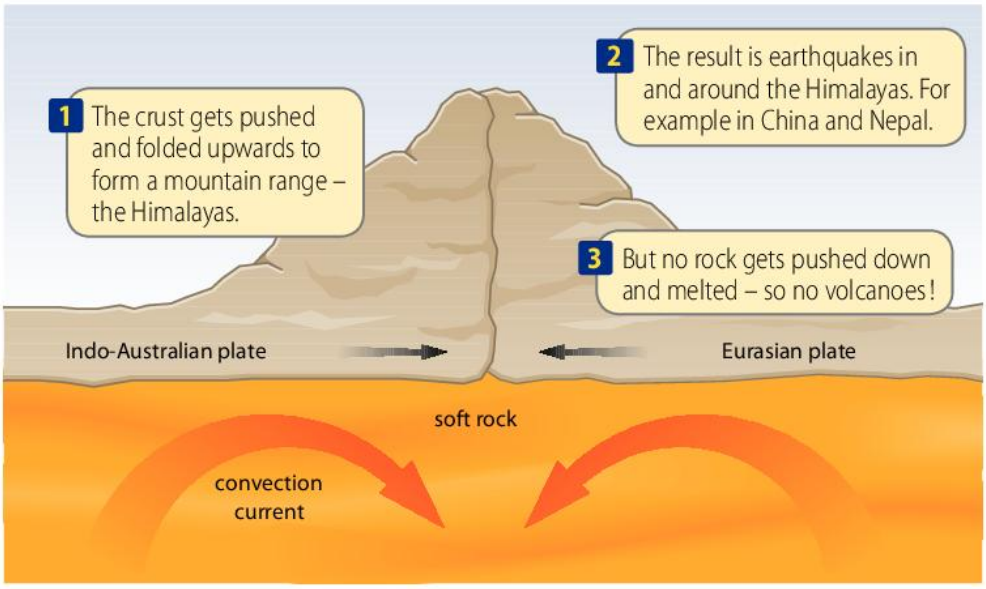
Fold mountains

As you saw, the Andes were formed by plates pushing into each other.

The Indo-Australian and Eurasian plates are also pushing into each other – on land. So rock was squeezed up to form the Himalayas.

The plates are still pushing. So the Himalayas are growing taller, by over 1 cm a year. And there are many earthquakes.

The mountains of the Himalayas and Andes are called **fold mountains**. Can you see why?

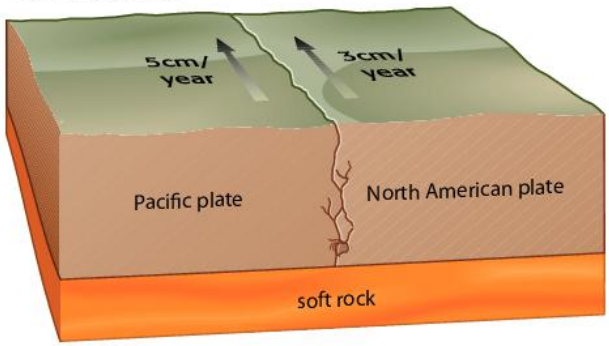


3 Some plates are sliding past each other

For example the Pacific plate is sliding past the North American plate. (Map!)

Both move in the same direction. But the Pacific plate is moving faster.

The result is earthquakes – but no volcanoes! And no mountains form.



1 Parts of the plates get stuck, then lurch free. This causes earthquakes.

2 But no rock gets pushed down and melted – so no volcanoes.

Your turn

1 a Make a table like this one, and complete it using ticks and crosses. A tick means 'yes'.

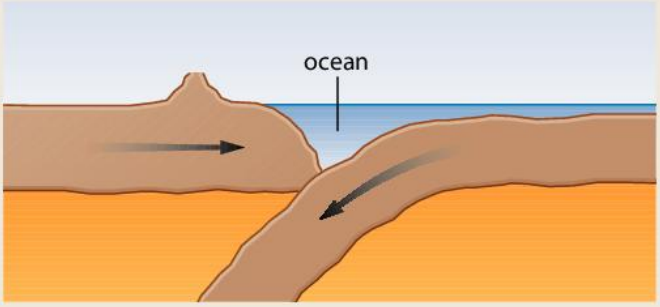
Plate movement ...	... gives earthquakes	... gives volcanoes	... builds mountains
1 Pushing into each other			
2 Pulling apart			
3			

b All plate movements cause ...?

2 Copy the drawing on the right. On your copy:
- a label the ocean plate, the continental plate and a volcano.
- b mark in melted rock that feeds the volcano.
- c mark in and label an earthquake site.

3 a What are *fold mountains*? (Glossary?)
b Using the maps on pages 88 and 140–141, explain why there are fold mountains, volcanoes and earthquakes in: i Peru ii Italy

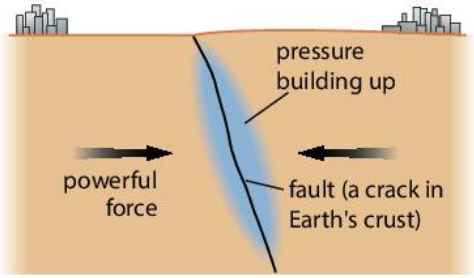
4 A mystery! The floor of the Atlantic Ocean is getting wider, as the plates pull apart and new ocean floor forms. But Earth is not getting any bigger. See if you can explain why. (Think about other plate movements.)



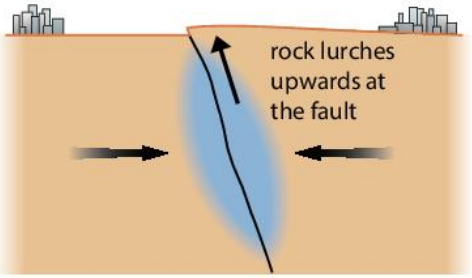
5.4 Earthquakes

Earthquakes can kill. Here you'll learn what they are, how they are measured, and what damage they do.

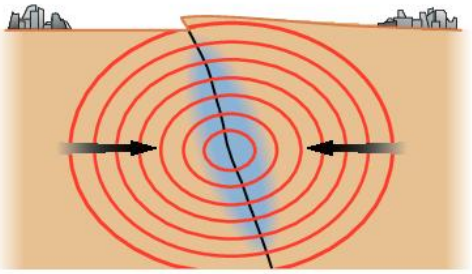
What is an earthquake ?



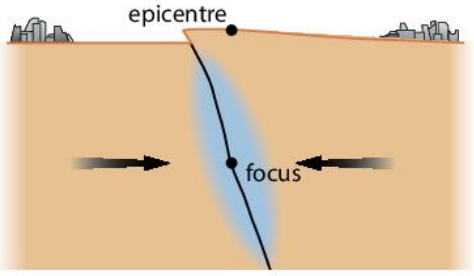
Imagine powerful forces pushing two huge masses of rock into each other. The rock stores up the pressure as **strain energy**.



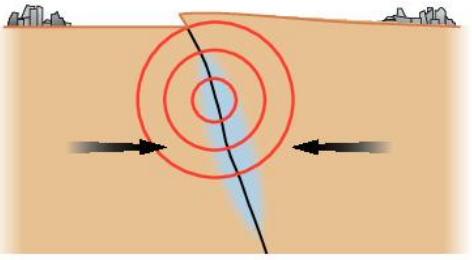
But suddenly, the pressure gets too much. One mass of rock gives way, slipping upwards. The stored energy is released in waves …



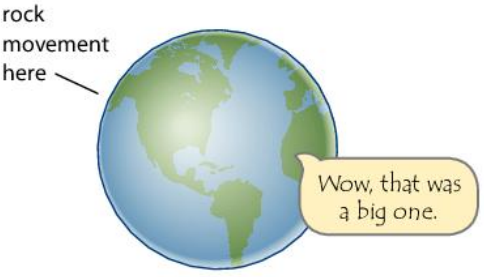
… called **seismic waves**. These pass through Earth in all directions, shaking everything. The shaking is called an **earthquake**.



The **focus** of the earthquake is the point where the waves started. The **epicentre** is the point directly above it on Earth's surface.



As the rock settles into its new position, there will be lots of smaller earthquakes called **aftershocks**.

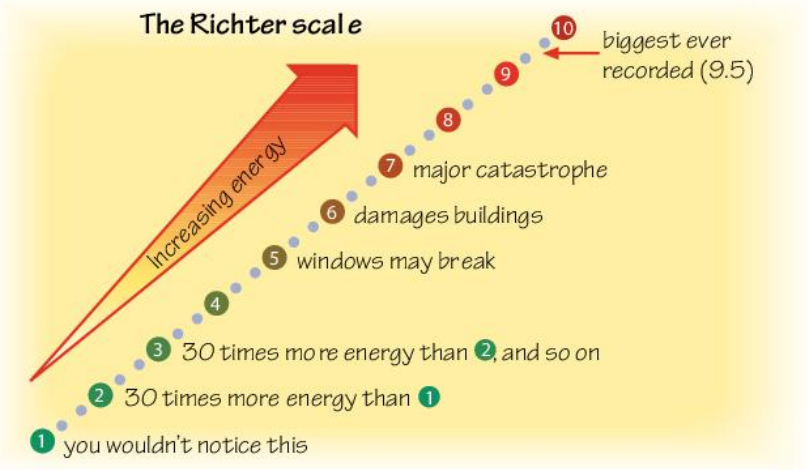


Seismic waves get weaker as they travel. Even so, a large earthquake can be detected thousands of kilometres away!

Any sudden large rock movement can cause an earthquake. That's why there are so many earthquakes along plate edges. But even the collapse of an old mine shaft can cause a small earthquake.

How big ?

- Earthquakes are measured using machines called **seismometers**. They record the shaking as waves on a graph.
- From the graph, scientists can tell how much energy the earthquake gave out.
- The amount of energy an earthquake gives out is called its **magnitude**.
- We show it on the **Richter scale**. (On the right.)
- An increase of 1 on this scale means the shaking is 10 times greater, and about 30 times more **energy** is given out. (So more damage is done.)



The damage it can do

An earthquake shakes the ground, which then shakes everything on it. So …

So earthquakes can destroy homes, villages, towns, and whole cities.

Your turn

1 Why do earthquakes happen so suddenly?

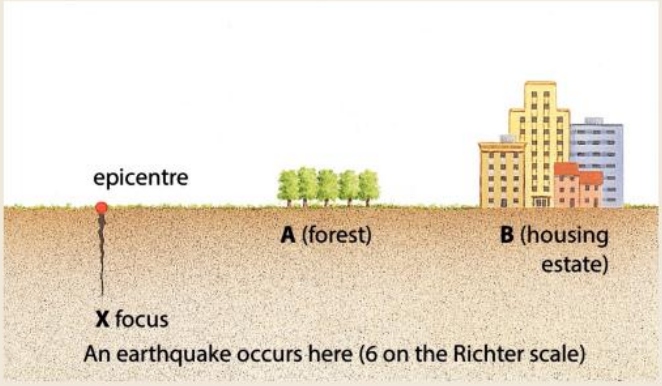
2 Explain in your own words what these earthquake terms mean. Use complete sentences.
- **a** seismic waves
- **b** focus
- **c** epicentre
- **d** magnitude

3 You are one of the people in the photo above. (Look carefully!) Describe what you see around you, in about 100 words.

4 Look at the earthquake diagram on the right.
- **a** Will the shaking be stronger at A, or at B? Explain.
- **b** Will the damage be greater at A, or at B? Why?
- **c** Will an earthquake of magnitude 7 do more damage than this one, or less? Why?
- **d** About how many times more energy will an earthquake of magnitude 7 give out, than this one?
- **e** An earthquake can occur at any time of day. When might an earthquake do more harm at B?
  - **i** at 5 am
  - **ii** at 10.30 am

  Explain your answer.

5 The largest earthquake ever recorded was in 1960, *in the ocean off the coast of Chile*. It measured 9.5 on the Richter scale. Use the maps on pages 88 and 140–141 to help you answer these questions.
- **a** What do you think caused the earthquake?
- **b** It left 2 million people homeless in Chile. See if you can explain how it managed to do that.
- **c** 22 hours later, it caused 200 people to drown on the east coast of Japan. How did it do that?



5.5 An earthquake in Southwest China

Here you'll learn why Southwest China is prone to earthquakes, and read about one example.

The Sichuan earthquake, 2008

A normal day in school

12 May 2008. It's a normal Monday afternoon in Beichuan Middle School, in Sichuan province, Southwest China. The 2900 students and teachers are deep in lessons.

But not for much longer. At 2.28 pm, over 140 km away, in the mountains, a large mass of rock starts to slip downwards. It sets off an earthquake.

Less than a minute later, Beichuan Middle School begins to shake. Books topple. Walls sway and crack. Door frames splinter. Ceilings crash down. Windows explode. People scream.

It seems to go on forever – but it lasts just two minutes. By then, two of the school buildings have collapsed, crushing students and teachers. In the days that follow, over 1300 bodies will be pulled from the rubble.

They are not alone. A third of Beichuan's population of 160 000 lie dead. 80% of its buildings have been destroyed. 10 000 people are injured.

Not just Beichuan

Villages, towns and cities across a large area of Sichuan are shaken. The death toll is over 87 000. Of these, 5300 are students who die in class. Over 12.5 million farm animals are killed, including 1 million pigs.

Earthquake-prone

China has many earthquakes – and many are in the southwest. In the hundred years up to 2008, earthquakes caused over 650 000 deaths in China. The 2008 earthquake is the costliest in financial terms.

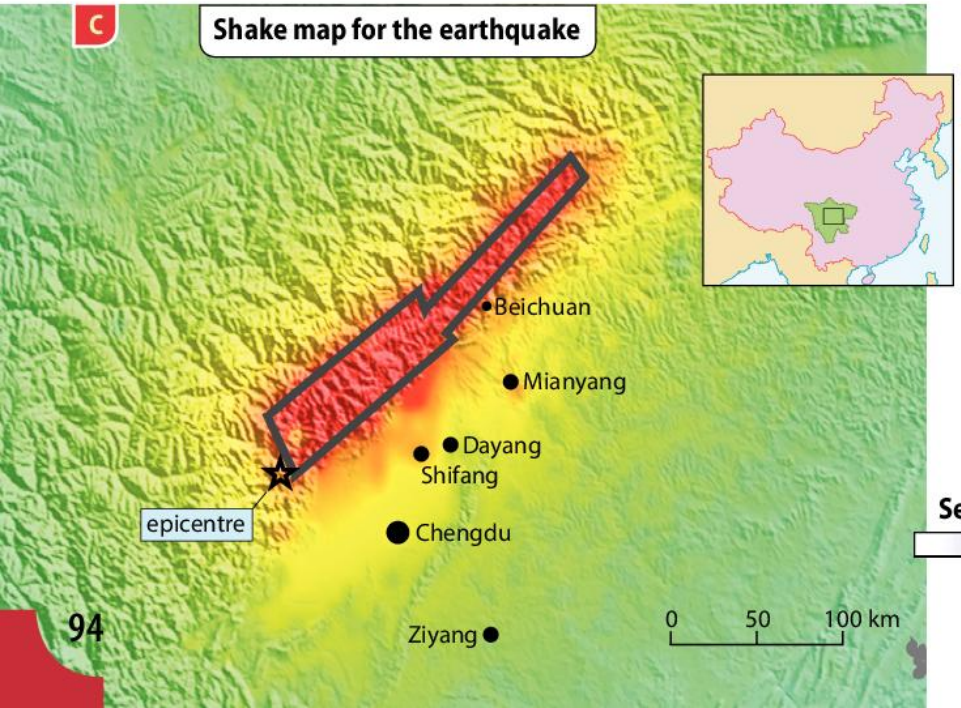
A

▲ *A student waits to be rescued, in Beichuan.*

B

▲ *Outside a school in Beichuan, after the earthquake.*

C



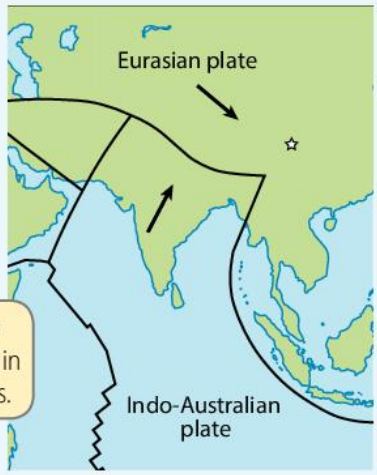
Sichuan 2008: earthquake factfile

date	Monday 12 May 2008
time	2.28 pm
magnitude	7.9 on the Richter scale
epicentre	in mountains in Sichuan, Southwest China
people	over 87 000 dead, over 370 000 injured, at least 5 million left homeless
financial cost	nearly £120 billion

What caused the earthquake?

Like most big earthquakes, this one was caused by plate movements.

D

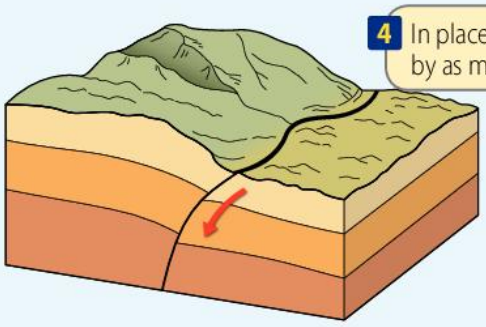


1 The Indo-Australian plate is pushing into the Eurasian plate.

2 The strain has caused many cracks or **faults** to develop in rock around the plate edges.

3 On 12 May 2008, the strain got too much at a fault in Sichuan. Rock slipped downwards all along the fault, setting off the earthquake. (The black star marks the location of the epicentre.)

4 In places, the rock dropped by as much as 12 metres.



Why were so many killed?

Earthquakes don't kill. Buildings do. That was the problem. Many buildings could not withstand the shaking. They collapsed, crushing people. Many were schools.

After the earthquake

Help poured in from the Chinese government. Soldiers led the rescue effort. Over the next few days, many people were pulled from the rubble, still alive. But then came the time when only dead bodies were found.

Later, parents blamed local officials for the deaths of their children. They said schools had been badly built, because the money intended for schools had been stolen, or used for other things.

Today

Across the stricken area, new homes have been built for people who lost theirs. Building regulations are now stricter – and in particular, for schools. Because one thing is certain: as long as those plates keep moving, there will be earthquakes in Sichuan, and other parts of China.

E

▲ *Rescued from the rubble in Mianyang.*

Your turn

1 Where is Sichuan? Give the continent *and* country.

2 Imagine you are the student in photo **A**. Describe what happened in your classroom during the earthquake … and then, how you were rescued.

3 What caused the earthquake? Explain in 30 words.

4 Look at shake map **C**. What do all the wrinkles tell you? (There are clues in the text, and in panel **D**.)

5 a What does the red colour on shake map **C** represent?
b The cities of Mianyang and Ziyang are similar in size. Mianyang suffered much more than Ziyang did. Why?
c Severe shaking was felt a long way from the epicentre. About how far away, at most? Use the scale.

6 There will be more earthquakes in Sichuan. Explain why.

7 The earthquake led to over 87 000 deaths. Do you think they could have been prevented? How? Explain.

5.6 Tsunami!

Earthquakes shake the ocean floor too, causing tsunami. Find out more here.

What is a tsunami?

Imagine a big earthquake in the ocean floor. It will set off waves that travel in all directions. These waves are called a **tsunami**.

Out in the ocean the waves may be only a metre high. But they can travel at over 700 km an hour. As they reach shallower water near a coast, they get slower, and taller. When they hit land they can be up to 30 m high.

▲ *People flee as the tsunami slams onto Raya island in Thailand.*

Tsunamis can be deadly

Tsunamis can kill people thousands of miles from the epicentre.

For example on 26 December 2004 there was an earthquake in the floor of the Indian Ocean. A huge one: 9.2 on the Richter scale. It caused a tsunami that left 300 000 people dead, and hundreds of thousands homeless, *across fifteen countries*. Follow the numbers in order.

1 The Indo-Australian plate is pushing north, and diving under the Eurasian plate. So the ocean floor in this region is under huge pressure.

2 On 26 December 2004, at 07.58 local time, a crack about 1000 km long appears in the ocean floor. One side jolts 10 m upwards.
The result: an earthquake.

3 Time zero: the waves begin …
… here, at the epicentre of the earthquake, 30 miles off Sumatra (Indonesia's longest island).

4 +15 minutes, tsunami hits Sumatra.
11 9000 people dead,
70 0000 left homeless.

5 + 90 minutes, Thailand is hit.
8700 people dead, many left homeless.

6 + 2 hours, Sri Lanka is hit.
37 000 people dead,
Over 1 million homeless.

7 + 2 hours, India is hit.
16 000 people dead,
376 000 homeless.

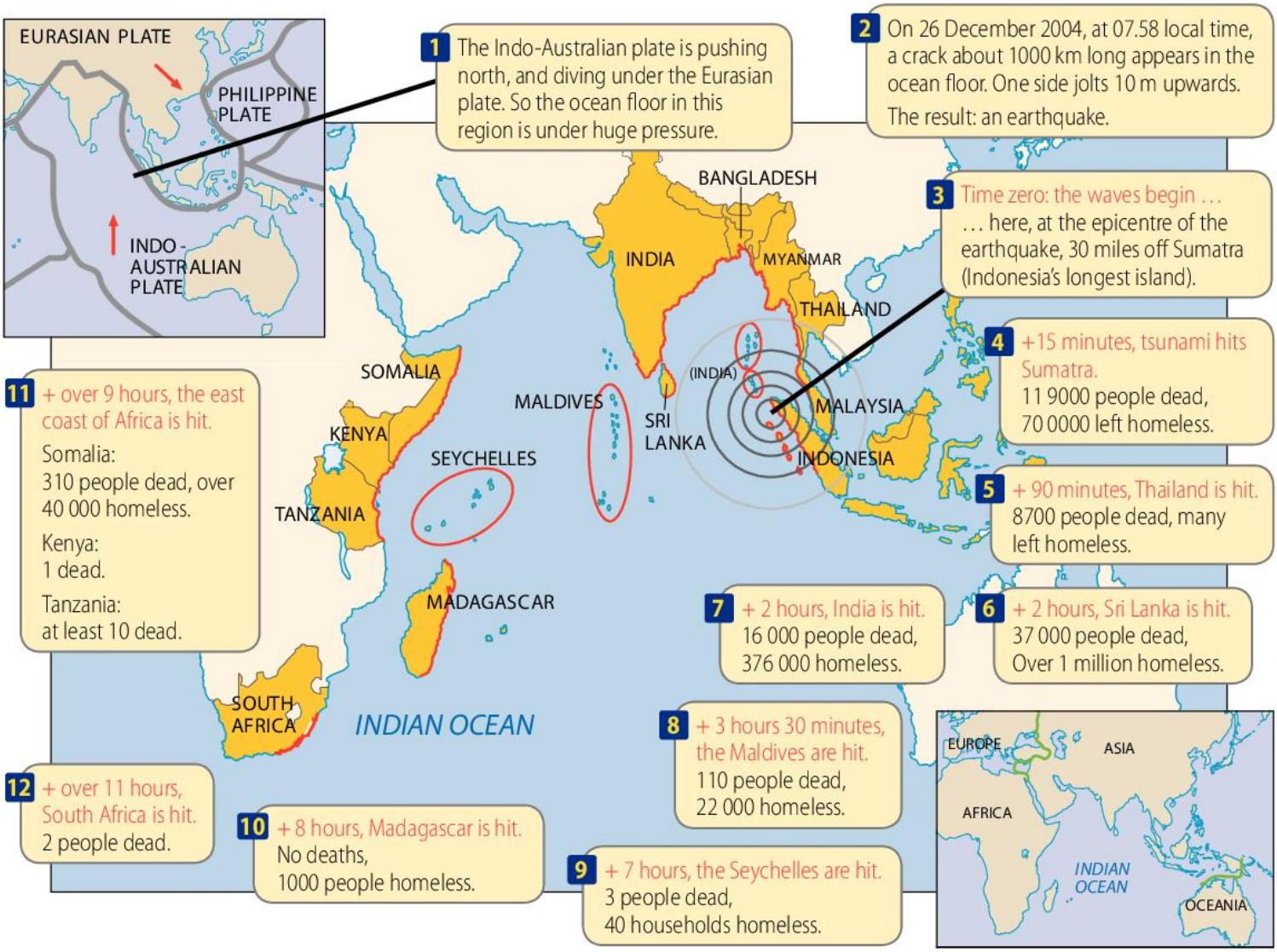
8 + 3 hours 30 minutes, the Maldives are hit.
110 people dead,
22 000 homeless.

9 + 7 hours, the Seychelles are hit.
3 people dead,
40 households homeless.

10 + 8 hours, Madagascar is hit.
No deaths,
1000 people homeless.

11 + over 9 hours, the east coast of Africa is hit.
Somalia:
310 people dead, over 40 000 homeless.
Kenya:
1 dead.
Tanzania:
at least 10 dead.

12 + over 11 hours, South Africa is hit.
2 people dead.



▲ *As a tsunami nears the coast, it sucks up water, exposing the ocean floor. This satellite image shows the water being dragged away, at the resort of Kalutara in Sri Lanka.*

▲ *The same resort, after the tsunami has struck. The water churns and recedes, leaving destruction behind. Both images were taken on 26 December 2004.*

The day they will never forget

Banda Aceh, Indonesia: I took an early ferry. I thought it was bouncing a bit, but that did not worry me. After an hour we got to Banda Aceh. I could not believe my eyes. The fishermen's homes along the water had gone. In the town, there were fishing boats on roof tops, and taxis stuck in trees. There were people sobbing, and corpses lying everywhere.

Telwatta, Sri Lanka: I was on the coast train, going see my family. Suddenly the train stopped. The sea started to pour in, very fast. The train turned over and over. I was trapped in there for nearly an hour, half drowned. But I'm lucky. They say there were 1500 passengers, and 800 of them died.

Khao Lak, Thailand: There was a hissing noise, and all the water along the beach got sucked out to sea. There were lots of fish left flapping on the ground. Children ran to look at them. Then there was a noise like thunder, and we saw a giant wave coming. The children had no chance.

(Adapted from news reports, end December, 2004)

▲ *Three days after the tsunami, on the island of Phi Phi in Thailand.*

Did you know?

- A 10-year old girl from the UK saved over 100 lives in Thailand, in the 2004 tsunami.
- She had learned about tsunamis in school, and told people to run from the beach.

A warning system

Because of the 2004 tsunami, there is now a tsunami warning system for the countries around the Indian Ocean. When an earthquake in the ocean is detected, people are warned through sirens and loudspeakers.

Your turn

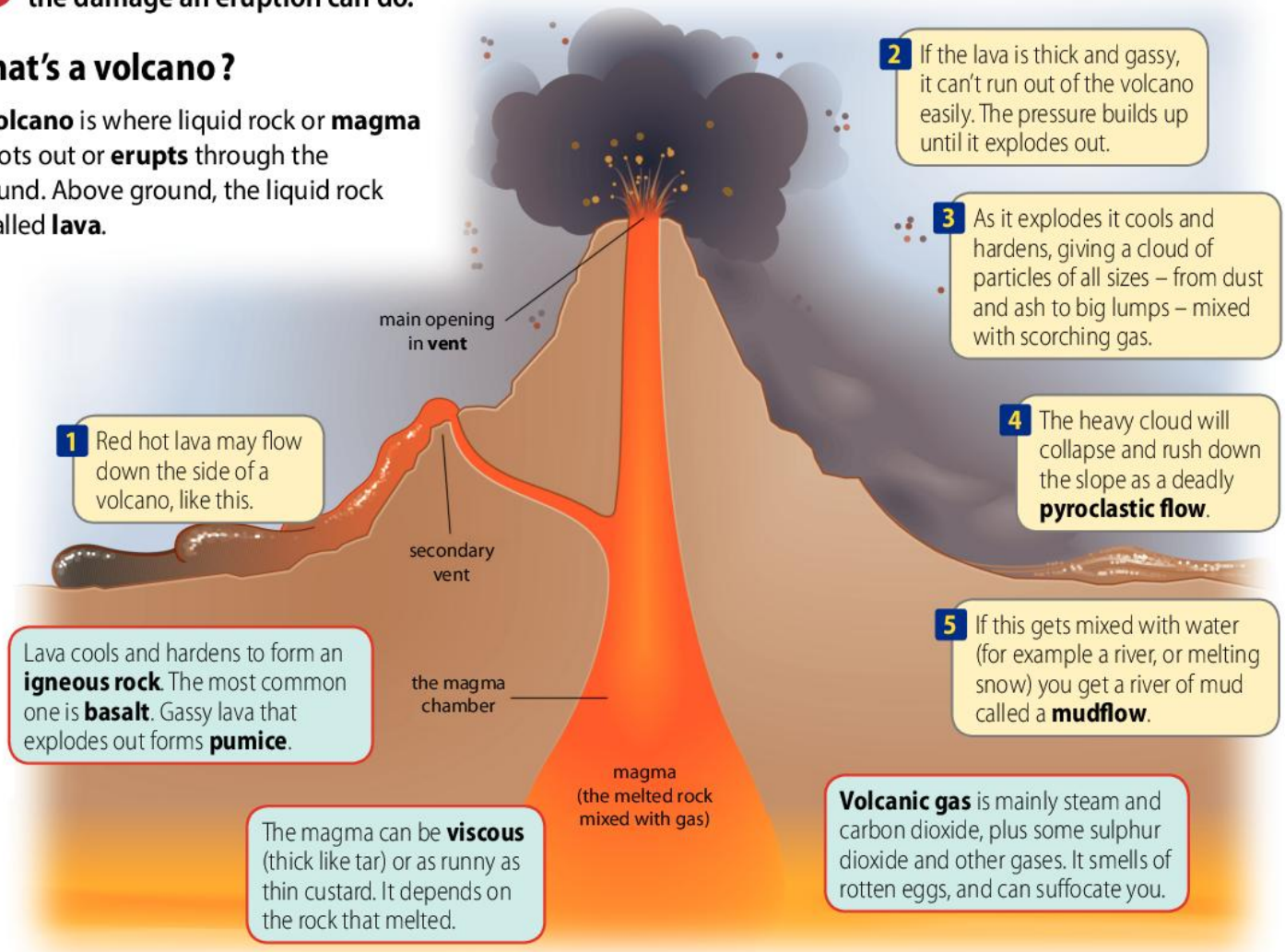
1. What causes a tsunami?
2. Try to explain these facts about the 2004 tsunami.
   a. It reached more than a dozen countries.
   b. It arrived at each country at a different time.
   c. Indonesia suffered much more than Somalia did.
   d. People out at sea were not aware of the tsunami.
   e. It did not reach the Philippines. (Page 141?)
3. Tsunamis can do far more harm than earthquakes do. Explain why.
4. Do you think a tsunami could strike the UK? Think carefully, and give your reasons.
5. A tsunami warning system includes a set of buoys that float on the water and give out signals. See if you can explain why these buoys are a very important part of the system.

5.7 Volcanoes

Hear you'll learn about volcanoes, and the damage an eruption can do.

What's a volcano?

A **volcano** is where liquid rock or **magma** shoots out or **erupts** through the ground. Above ground, the liquid rock is called **lava**.



Viscous gassy lava is the most dangerous kind. It builds up inside the volcano. Then the gas propels it out in an explosion.

A

▲ *Runny lava flowing into the Pacific Ocean in Hawaii, USA.*

B

▲ *Ash and steam erupting from Popocatépetl, a volcano in Mexico. The hollow around the vent is called a **crater**.*

What damage can eruptions do?

A pyroclastic flow travels at up to 200 km an hour. You can't escape. It scorches and smothers everything.

Mudflows can travel at 100 km an hour. They sweep everything along. You drown in mud.

Lava flows destroy crops, and bury towns and villages. (They can kill too – but you can just walk out of the way.)

A blanket of ash will ruin crops.

Dust from an explosive eruption may rise high in the atmosphere and block out the sun. Temperatures around the world will fall.

The dust can also cause planes to crash.

Volcanic gas causes acid rain. This kills trees and plants over a wide area.

A thick layer of ash can be heavy enough to make roofs collapse.

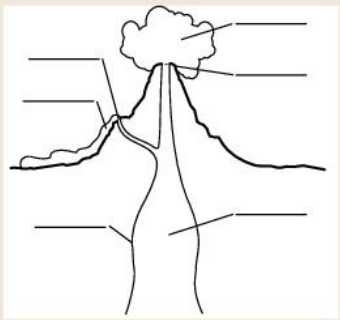
The ash from an explosive eruption gets everywhere – in your eyes, your hair, your lungs. It can suffocate you.

This photo shows an eruption on the island of Montserrat, in the Caribbean.

Your turn

1 Look at photos **A**, **B** and **C**. None of them shows magma. Why not?

2 Make a larger copy of this drawing of a volcano. Colour in your copy, and add the missing labels.



3 Photo **C** shows the Soufrière Hills volcano on Montserrat. It began erupting in 1995. It has been active ever since.
- **a** That town (called Plymouth) has been abandoned. Why?
- **b** What do you think is in the big dark cloud?

4 An active volcano can produce:
showers of ash a pyroclastic flow a lava flow
plumes of dust volcanic gases
- **a** List them in order of danger, starting with what you think is the most dangerous one.
- **b** Beside each item in your list, say what harm it does.

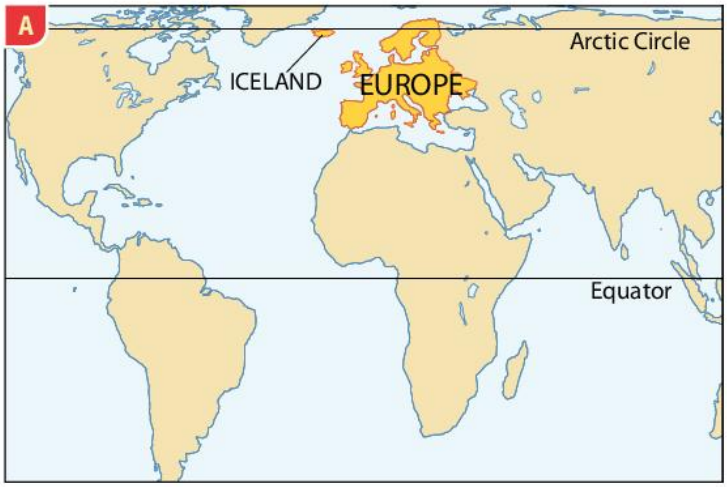
5 The photo below shows the eruption of Mount Pinatubo in the Philippines, in 1991. You are a reporter. You took the photo. Write a report describing what you saw before you took it – and what happened next.

5.8 Iceland: a country made by volcanoes

Here you will learn how Iceland was formed – and why it has so many active volcanoes.

Meet Iceland

Imagine an island nearly half the size of Britain, up beside the Arctic Circle, with a population about the same as Coventry (326 000). And with over 30 active volcanoes. That's Iceland!



▲ *Iceland: just south of the Arctic Circle.*

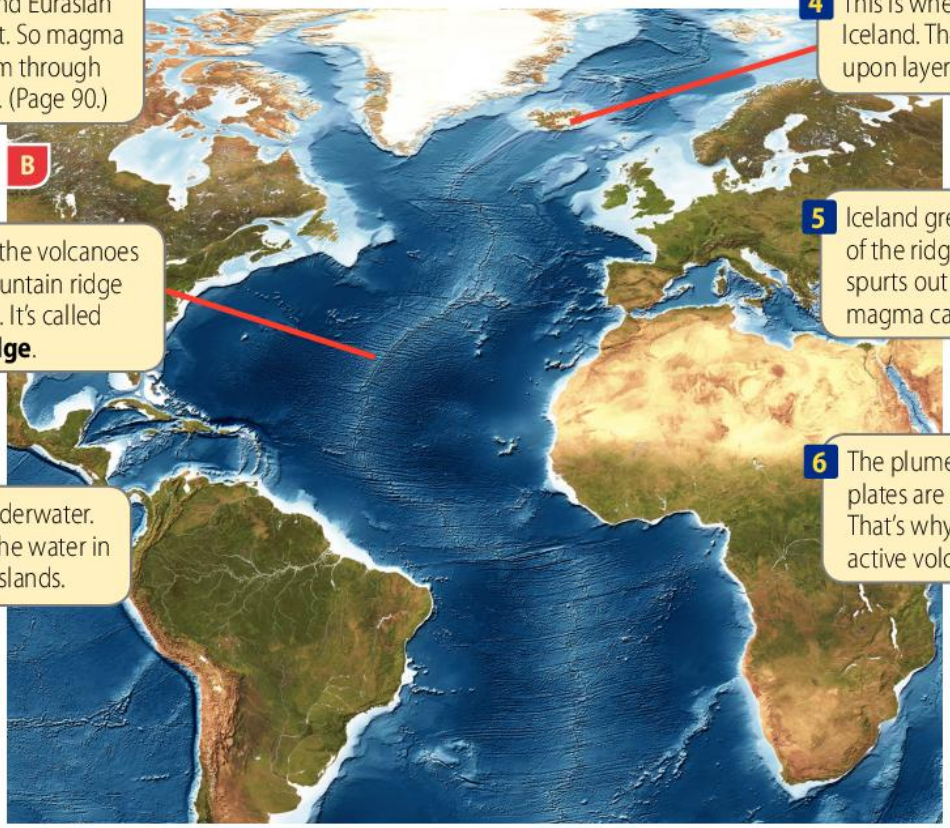
Made by volcanoes

Look at image **B**. It shows the mountains on the ocean floor as well as those on land. Follow the numbers to see how Iceland was formed.

1 The North American and Eurasian plates are pulling apart. So magma wells up between them through underwater volcanoes. (Page 90.)

2 Over 70 million years, the volcanoes have grown into a mountain ridge about 16 000 km long. It's called the **Mid-Atlantic Ridge**.

3 Most of the ridge is underwater. But it sticks up out of the water in a few places, forming islands.



4 This is where it sticks out and forms Iceland. The island is made of layer upon layer of volcanic rock.

5 Iceland grew taller than other parts of the ridge because extra magma spurts out here, fed by a current of magma called a **plume**.

6 The plume is still there. And the plates are still moving apart. That's why Iceland has so many active volcanoes.

The most deadly eruption in history

In 1783, a violent eruption began in Iceland, at a fissure called Laki. It lasted for 8 months! Lava spewed out non-stop. Millions of tonnes of sulphur dioxide and other poisonous gases were pumped into the air.

The eruption killed crops, and animals, and people. Many died from famine – and not only in Iceland. The deadly gases spread across the atmosphere. It is thought that over 6 million people around the world died as a result of the eruption. At least 20 000 died in the UK.

Did you know?

- The Mid-Atlantic Ridge was discovered in 1872 …
- … when scientists were deciding where to lay a trans-Atlantic telegraph cable.

Eruptions in Iceland … and us

Let's hope that there won't be another massive eruption like Laki, in Iceland. But there will be eruptions – and even much smaller ones can affect us.

For example In April 2010, an eruption in Iceland threw many tonnes of ash high into the air. It spread. Over the next six days, flights were cancelled in the UK and other parts of Europe, because ash can damage plane engines.

Some benefits of living in Iceland

The volcanic activity in Iceland is not all bad news!

- Iceland has some stunning volcanic scenery.
- It has hot springs, and geysers, which attract tourists.
- Cold water is piped down to the hot rocks. This gives steam which is then piped to heat homes, or to generate electricity.

▲ *The eruption in 2010. The volcano is called Eyjafjallajokull. Pronounce that!*

▲ *A warm soak in Iceland's Blue Lagoon. The water is pumped from the ground near a lava flow, and used in a power station first.*

▲ *A lava field in Iceland. As it flowed along, the lava cooled and hardened.*

Your turn

1. Where is Iceland? Describe its location carefully. Include the name of the continent. (Page 140?)
2. Iceland sits on the border of two plates. Which two?
3. How was Iceland formed? See if you can explain by doing a set of drawings, a bit like those on page 90.
4. True or false?
   - a Iceland is part of a long ridge of mountains which stand on the ocean floor.
   - b Iceland is made of granite. (Pages 8 and 87!)
5. See if you can explain these.
   - **A** Iceland is growing wider by about 5 cm a year.
   - **B** Many *faults* have developed in Iceland's rock.
   - **C** Iceland has lots of earthquakes.
   - **D** Fuel bills are low, for households in Iceland.
6. Would you like to visit Iceland? Yes or no? Explain.
7. See if you can pick out somewhere else, on the map on page 88, where you'd expect to find a mountain ridge under the water.

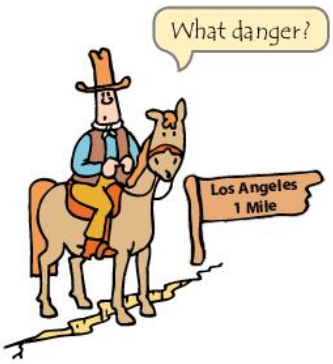
5.9 Why live in a danger zone?

It's dangerous near plate edges. But people still live there. Why? Find out here – and learn how plate movements benefit us!

What if...
◆ ... the UK was in a danger zone?

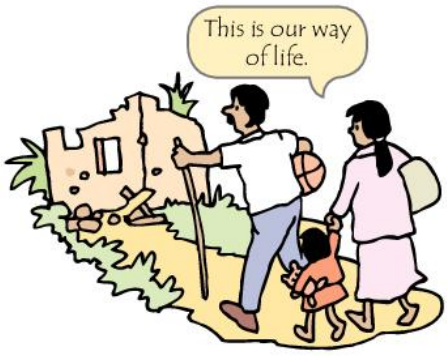
Crazy or what?

Many millions of people live near plate edges, where there's a high risk of earthquakes and eruptions. Why don't they move somewhere safer?



People settled in danger zones before we understood the risks. (We didn't know about Earth's plates until the 1960's.)

Some settlements in danger zones are enormous cities. Mexico and Tokyo, for example. Where would everyone go?



Even after a disaster, most people want to return to the life they know best. They hope another disaster won't happen.

A good job and a nice life may keep you in a danger zone, even if you feel nervous. Besides, you may feel safer because ...

... scientists monitor volcanoes, and are getting better at predicting eruptions. So they can warn you to move to safety.

They can't predict earthquakes ... yet. But engineers do design quake-proof buildings, bridges, and other structures that won't collapse.

▼ *Mount Fuji, Japan. It attracts many tourists. It last erupted in 1708.*

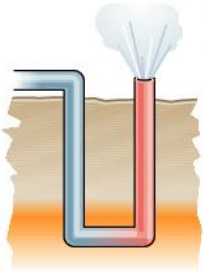
▼ *Mount Etna, in Sicily, Italy. It is Europe's most active volcano.*

Now for the good news!

You've met the bad news: plate movements can kill.
The good news is: they also bring benefits – thanks mainly to volcanic eruptions.

Good soil. Lava breaks down to give very fertile soil. On Mount Etna in Sicily, the soil gives farmers rich crops of grapes and other fruit. In Java and Japan they grow rice.

Money from tourism. Volcanic areas attract tourists, and tourists spend money! They flock to visit Mount Etna and Mount Fuji, and the volcanoes of Iceland. They can see **geysers** and **fumaroles**, and relax in hot springs.



Geothermal energy or heat energy stored in rock. As you saw on page 101, water can be pumped down onto the hot rocks. It comes back up as steam. This is used to heat homes, or drive turbines to make electricity.

Over 90% of Iceland's homes are heated by geothermal energy.

Valuable materials. Copper, silver, gold, and lead are found in extinct volcanoes. (They collect in **veins** when magma cools and hardens.) Sulphur is mined around old volcano vents. Basalt is used to build roads.

Fossil fuels. Plate movements push some rock upwards. It is weathered, and eroded, and eventually forms sediment on the ocean floor. (See page 12.) The remains of sea creatures that are buried in the sediment turn into oil and gas.

Plate movements also led to vegetation being buried deep in swamps. In time, it turned to coal.

▲ *Old Faithful, a famous geyser in Yellowstone National Park in the USA. It erupts over 20 times a day.*

Your turn

1 Using the world map on pages 140–141, and the plate map on page 89, name six capital cities which appear to be in danger zones.

2 Give: **a** two economic reasons **b** two social reasons to explain why people continue to live in danger zones.

3 Do you agree with this person? Give reasons.

4 In what ways do plate movements benefit *you*? (Things like gas for cooking?) Give your answer as a spider map.

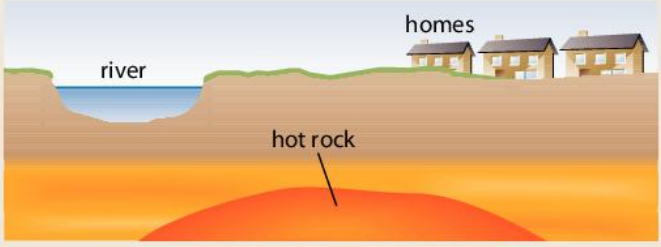
5 In what ways do its volcanoes benefit Iceland?

6 Can you think of anyone who benefits from earthquakes? Give as many examples as you can.

7 What is a *fumarole*? (Glossary.)

8 Look at Old Faithful. What do you think is happening below ground? Explain as clearly as you can. Would a diagram help?

9 You are an engineer. Copy this drawing and complete it to show how you could heat those homes.



6 Russia

The big picture

This chapter is about Russia. Here's the big picture …

- Russia is a big important country – the world's biggest, in area.
- It lies partly in Europe, but mostly in Asia.
- It extends into the Arctic, so has very cold winters and cool summers, overall.
- It is very rich in natural resources.

Your goals for this chapter

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

- Where exactly is Russia, and what is its full name?
- Explain these terms: *European Russia* *Siberia*
- Say roughly where these are, and be able to find them quickly on a map:
  - the Volga, Amur, Ob, Yenisey, and Lena rivers
  - the East European Plain, West Siberian Plain, and Central Siberian Plateau
  - the Ural and Caucasus mountain ranges, and Mount Elbrus
  - the Caspian Sea, Baltic Sea, Black Sea, and Lake Baikal
  - the Kamchatka and Kola peninsulas
- Name and describe briefly: Russia's climate zones Russia's biomes
- What is *permafrost*, and where will you find it in Russia?
- Describe, and explain, the pattern of population density in Russia.
- Name these Russian cities, and point out their location on a map:
  - the two biggest cities
  - the top holiday resort
  - three ports (two on the Baltic Sea, one in the Arctic)
  - the city at the eastern end of the Trans-Siberian railway
- Where in Russia is the *Sakha Republic*?
- Give at least six geographical facts about the Sakha Republic.
- Where is Crimea, and what is its connection with Russia?

Why …
- … is Russia so big?

Did you know?
- One day there may be a rail tunnel between Russia and the USA, under a stretch of water called the Bering Strait.

Did you know?
- They say millions of woolly mammoths lie buried in the permafrost in Siberia.

Did you know?
- If you are Russian, and male, you must do a year in the army once you reach 18.

What if…
- … you'd been born in Russia?

What if…
- … you could speak Russian?

And then …

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

Your chapter starter

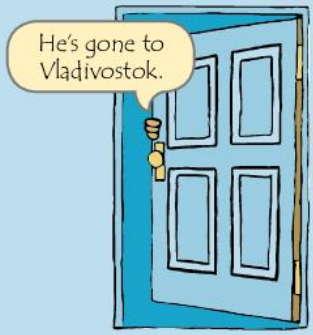
Look at the images on page 104. They are all about Russia.

Which continent is Russia in? Are you sure?

Do you think it's a poor country? What is your evidence?

What else can you say about it, just from these images?

What else do you know about Russia?



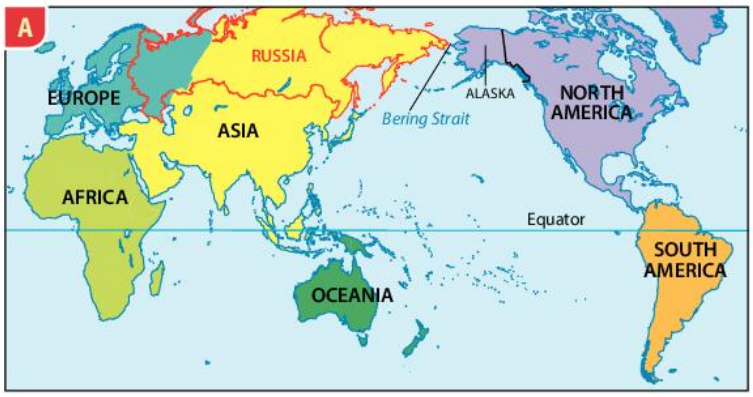
6.1 Meet Russia

This unit introduces Russia – a big country that's often in the news.

Where is it?

Russia is a big, powerful country. Where is it?

- It spreads across the top half of **Asia**, and into **Europe**. Look at map **A**.
- Its coastline borders two oceans.
- It is only 82 km from Alaska in the United States, across a strip of sea called the **Bering Strait**.



▲ *The red line marks Russia's border. Alaska, in the USA, was once a Russian colony. The USA bought it from Russia in 1867.*

Zooming in …

Look at map **B**. Russia shares a land border with fourteen countries.

Note the small Russian **exclave** next to Lithuania. It is called **Kaliningrad**.

Look at the countries in pale pink. For much of the 20th century, Russia and these countries formed the **Union of Soviet Socialist Republics**, or **USSR**. It was also called the **Soviet Union**. It was controlled from Moscow, Russia's capital. But it broke up in 1991.

Now find **Crimea**. Under international law, it is part of Ukraine. But it is run by Russia. In 2014, residents – supported by Russia – voted for it to become part of Russia. This vote was condemned as illegal by the governments of Ukraine and other countries, including the UK.

Did you know?

- The United Nations (a body which almost all countries belong to) does not accept that Crimea is part of Russia.

Key

- Russia
- formerly part of the USSR, with Russia
- other countries that border Russia

What's it like ?

Russia is a fascinating country. Here's an overview.

- **Size** Vast: 17.1 million sq km. That's about 70 times bigger than the UK.
- **Time zones** Russia is so wide that it has 11 time zones. At midday in Kaliningrad, it's 10 pm in Kamchatka ! (Find them on map **B**.)
- **Population** 146 million people – only about 2.3 times more than the UK.
- **Empty in places** Huge areas of Russia are empty. You can't reach them by road or rail. (You could hire a helicopter.)
- **Arctic in places** Look how the Arctic Circle runs across it.
- **Landscapes** Frozen tundra, vast forests, grassy plains, sunny beaches, mountains, volcanoes, and long long rivers. Russia has it all.
- **Natural wealth** Russia is rich in natural resources: oil, gas, coal, timber, metals, diamonds. It depends heavily on exporting oil and gas.
- **Billionaires** You'll find quite a few billionaires in Moscow, the capital. But Russia also has many poor people.
- **A rich history** Russia was once a great empire. The emperors were called **Tsars**. You can read more about the Russian Empire in the next unit.

▲ *Up and away ! Russia was first to send people into space. Today its spacecraft ferry scientists to the International Space Station, 400 km above Earth.*

▲ *They look cuddly – but watch out ! Russia has lots of brown bears.*

◀ *Nicholas II, the last Tsar of Russia, on a visit to Queen Victoria in 1896. His wife Alexandra, holding the baby, is Queen Victoria's granddaughter. On the right is Victoria's son Edward, Prince of Wales.*

Your turn

1 a Russia lies on two continents. Which two ?
  b Which continent has the bigger share ?

2 a Look at map **B**. Name:
  i three Asian countries ii four European countries which border Russia. Map **A** will help.
  b Which country shares the *longest* border with Russia ?

3 Which two oceans border Russia ?

4 Find Kaliningrad on map **B**. It is an exclave of Russia. What's an *exclave* ? (Glossary ?)

5 The stretch of water between Russia and Alaska is called … ?

6 About how much of Russia is north of the Arctic Circle ? Choose one: a half b one-tenth c one-fifth

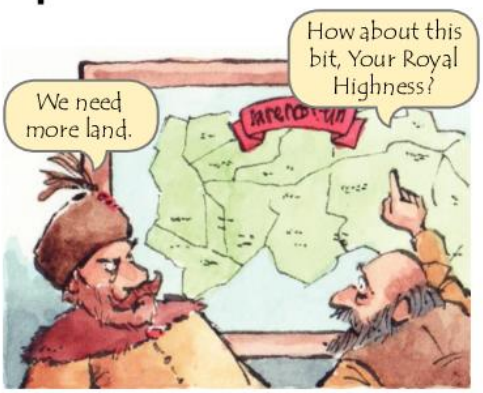
7 Russia has many different types of environment. But it has no tropical rainforests. Why not ? (Page 141 may help.)

6.2 A little history

Knowing a bit about its history will help you understand Russia.

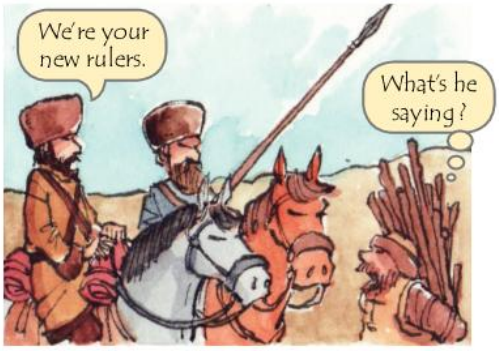
From the start of the Russian Empire …

The Russian Empire began around 1300 AD, as the state of **Muscovy**. About the size of Wales, it was centred on **Moscow**, and ruled by princes.



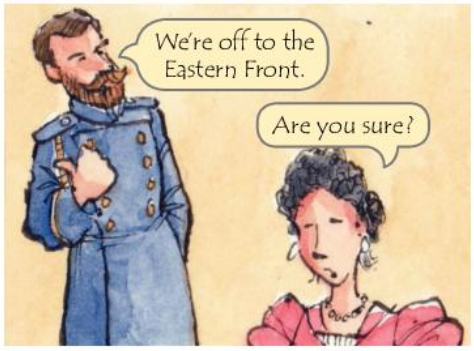
The princes were ambitious, and took over more and more land. Muscovy grew larger and more powerful. The most ambitious prince of all …

… was **Ivan the Terrible**. He made himself **Tsar** (or Emperor) of Russia. By the time he died in 1584, Muscovy was 270 times bigger than in 1300.



Later Tsars continued to expand the empire. Peoples of faraway lands and different ethnic groups were taken over. (It usually involved fighting!)

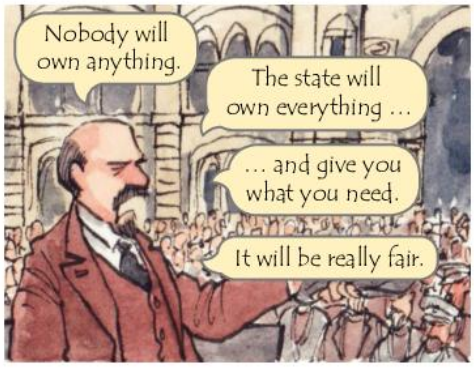
The tsars and nobility grew more and more wealthy. Most other people were poor peasants. Many were **serfs**, 'owned' by noblemen.



Nicholas II was the Tsar when World War I began. He brought Russia into the war on the side of the Allies: UK, France, and others. The Allies won.

But the Russian army suffered huge losses. And meanwhile, back home, people were short of food and fuel. They blamed the Tsar.

So in 1917, even before the war had ended, there was a **revolution** in Russia. Nicholas II was deposed. No more emperors, ever!



That revolution was soon followed by another, in 1919. The **Bolsheviks**, led by **Lenin**, took over. The Bolsheviks were **communists**.

Lenin reorganised the Russian Empire to form the **USSR**: the Union of Soviet Socialist Republics. The republics were created along ethnic lines.

Lenin died in 1924. **Stalin** took over. He aimed to make the USSR a great industrial power. He achieved this very quickly – and often by brutal means.

Then came World War II. The USSR joined the Allies (UK, France, USA, and others) in 1941, and played a big part in helping to defeat Germany.

But during the war, Stalin seized the chance to extend the USSR, and its influence, further into Europe. This made other countries very hostile.

Stalin died in 1953. Other leaders followed. In 1985 **Mikhail Gorbachev** took over. He wanted people to have more freedom.

That led to an unexpected result. In 1991, the republics which formed the USSR voted to leave it! The USSR broke up. Russia was alone.

Russia today

Today, Russia's full title is the **Russian Federation**.

It is divided into **federal districts**, to make it easier to govern. These are in turn divided into lots of smaller units. Look at this map.

Russia is still governed from Moscow. But the Communist Party is no longer in power. Now people can choose who will govern them, by voting.

▲ *Each colour represents a federal district. The districts are divided into smaller units, such as* **republics** *and* **oblasts**.

Your turn

1 a See how many different empires you can name, in history.
b Try to think of *two* things they had in common.

2 Name the first two leaders of the USSR.

3 Think about what the communists believed. (Bottom right, page 108.) See if you can explain why it appealed to ordinary Russian people, when Lenin took over in 1919.

4 Stalin was very popular in the UK for a time. Suggest a reason.

5 *Russia underwent enormous conflict and change in the 20th century.* Give evidence to support the statement in italics.

6 Russia is governed from Moscow. From what you know about Russia already, see if you can come up with *three* factors which might make it difficult to govern. (Page 107 may help.)

6.3 Russia's main physical features

By the end of this unit, you should know about Russia's main physical features!

A map of Russia's main physical features

Mountains

- The **Ural Mountains** form a natural border between Asia and Europe. Asian Russia – to the east of them – is usually called **Siberia**.
- Now look for the **Caucasus Mountains**. Their highest peak is **Mount Elbrus**. At 5642 metres, it is Europe's highest mountain.
- As you can see, the Asian part of Russia has more high land, overall.

Plains and plateaus

Russia's plains and plateaus cover vast areas.

- The **East European Plain** is where most of Russia's population lives. It has the best farmland, and a less harsh climate overall.
- The **West Siberian Plain** is low and flat. It has lots of boggy land, and coniferous forests, and frozen tundra north of the Arctic Circle. Under this plain lies the world's largest basin of oil and gas reserves.
- The **Central Siberian Plateau** is an upland area, flat in places. Most of it is covered in coniferous forest. It is rich in resources: coal, oil and gas, nickel, iron, copper, gold, silver, platinum, diamonds, and more.

▲ *Mount Elbrus, Europe's tallest mountain. It's a volcano with two peaks, in the Caucasus mountain range. It last erupted about 2000 years ago – but still gives off fumes.*

Lakes and seas

- Look at **Lake Baikal**. It is the world's oldest and deepest lake (but not the largest in area). It holds about *one-fifth* of Earth's liquid fresh water!
- The **Caspian Sea** is called a sea, and is a bit salty. But it's really a huge lake – the world's largest in area. It lies below sea level. Over 130 rivers flow into it – the Volga is the biggest. But none flow out. It does not overflow, because it loses water by evaporation.
- Next, the **Baltic Sea**. It is bordered by Kaliningrad, the Russian exclave. It joins the North Sea.
- The **Black Sea** flows into the Mediterranean Sea. The climate around the Black Sea is mild, with warm sunny summers. So this is where you'll find Russia's seaside resorts.

▲ *Lake Baikal in winter – frozen!*

Rivers

- Look at the **Volga**. It's the longest river in Europe. It has a special place in Russian history and culture.
- Now look at the great rivers of Asian Russia which flow north for thousands of kilometres, to the Arctic Ocean. From left to right on the map:
  - the **Ob**; the **Irtysh** is its main tributary.
  - the **Yenisey**
  - the **Lena**.
- And another long one: the **Amur**. It forms a natural border between Russia and China.

▲ *A cargo of timber on the River Volga. The river is used a lot for transport.*

Volcanoes

- The **Kamchatka Peninsula** and the **Kuril Islands** have lots of active volcanoes. That's because they lie near the edge of the Pacific tectonic plate. They are part of the **Ring of Fire** around the Pacific Ocean (page 88).
- Mount Elbrus is also a volcano. It last erupted about 2000 years ago. It too lies near a plate boundary. (Over millions of years, plate movements closed up an ancient ocean, and folded land up to form the Caucasus Mountains.)

▶ *The tallest volcano in Kamchatka erupting. It is Mount Klyuchevskaya (4750 metres).*

Your turn

1 Which of Russia's physical features …
   - a acts as the border between Europe and Asia?
   - b contains Europe's highest peak?
   - c contains the largest basin of oil and gas in the world?
   - d lies between the Bering Sea and the Sea of Okhotsk?
   - e contains about 20% of the world's liquid fresh water?
   - f is a salty lake, shared with several other countries?

2 What and where is *Siberia*?

3 Russia has many thousands of rivers and lakes, of all sizes. The map shows the main ones. Only some are labelled.
   - a Which river forms a border between Russia and China?
   - b i Name five other Russian rivers, from the map.
     ii Name one that lies in Europe.

4 Now … start a spider map to summarise what you know about Russia. Use a big sheet of paper, so that you can add more points in later lessons. Choose suitable headings.

6.4 Russia's climate zones and biomes

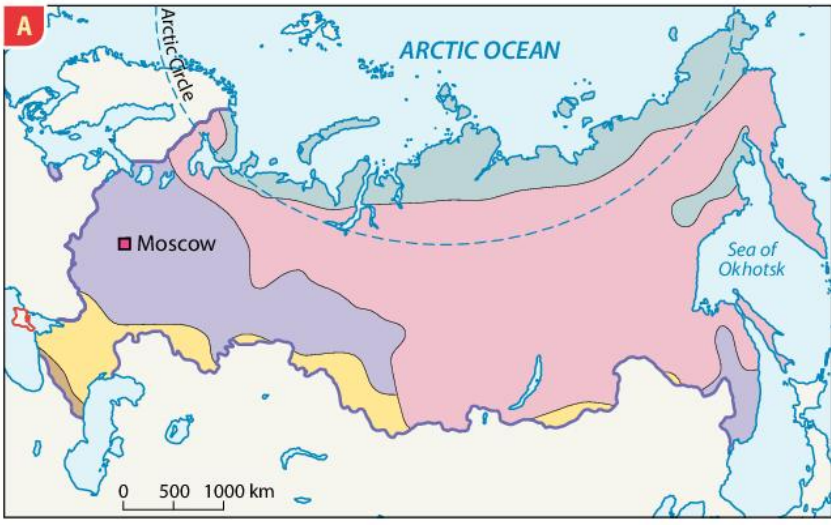
Russia is big – and that means different climate zones, with different vegetation. Find out more here.

Russia's climate zones

Russia's climate is dictated by **latitude**, **altitude**, and **distance from the sea**. (Land further from the sea gets warmer in summer, and cooler in winter.)

Look at map **A**, and match the colours to this key.

tundra	long bitterly cold dark winters, short cool summers, precipitation low
sub-arctic	long very cold winters, short cool summers, precipitation low
humid continental	cold winters, warm/hot summers, precipitation higher (most in summer)
semi-arid	cold winters, hot summers, dry
mountain	the higher you go, the colder it gets



Much of Russia is under snow for up to eight months of the year. The tundra and sub-Arctic climate zones have **permafrost** – frozen soil below the ground, which stays frozen even in summer. In parts of Siberia, the permafrost is over 1 km thick!

Precipitation is low, overall. For two reasons: most land is far from the sea, and mountains south of Russia block moist air. Rain falls mostly in summer.

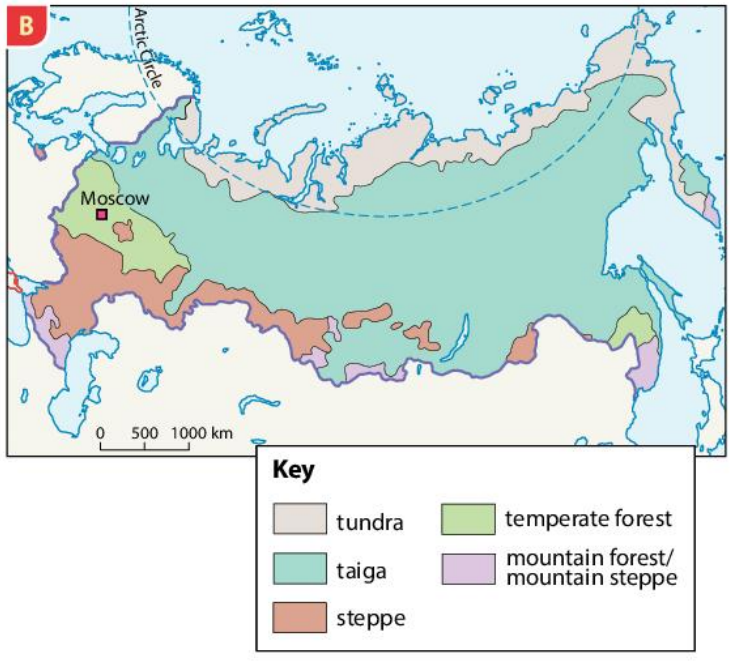
▲ *An Arctic fox in the tundra.*

Russia's biomes

Biomes are regions with similar natural vegetation, and animals. Map **B** is a simplified map of Russia's biomes. The boxes will tell you more.

Tundra

The **tundra** biome is covered in ice and snow in winter. But in summer the surface of the soil thaws, and low plants and shrubs grow. You may see musk ox, Arctic foxes, polar bears, grizzly bears, reindeer, and ermine.



Taiga

The **taiga** is a biome of coniferous forest – trees like larch, spruce and pine, with needles instead of leaves. Larch has shallow roots, so is common in permafrost. Watch out for bears, and wolves, and Siberian tigers!

Temperate forest

Here you'll find a mixture of trees: deciduous trees such as oak and ash which lose their leaves in winter, plus coniferous trees such as spruce and pine. And you may see wolves, foxes, deer, and squirrels.

Steppe

This biome is grassland, with few trees, and generally fertile soil. So farmers rear cattle here, or plough the land to grow crops such as wheat and barley. You'll find small animals like hamsters and mice.

Mountain forest / mountain steppe

The higher you go, the colder it gets. The soil gets thinner, and vegetation more sparse. Above a certain height – the **tree line** – no trees will grow. You may find mountain goats, deer, lynx, and foxes.

Your turn

1 Explain how these affect climate. (Glossary?)
a latitude b altitude c distance from the sea

2 a Overall, which is the main type of climate in Russia?
b Which has a milder climate: European Russia, or Siberia?

3 a Page 112 refers to *precipitation*, not rain. Why?
b Precipitation in Russia is generally low. Explain why.

4 Which is the main biome in the sub-arctic climate zone?

5 Is there a link between climate and biomes?
To decide, compare maps **A** and **B**. Look for patterns. Give at least three pieces of evidence to support your answer.

6 Which of the biomes might be easiest for humans to live in?
Write 50 – 100 words, giving your reasons.

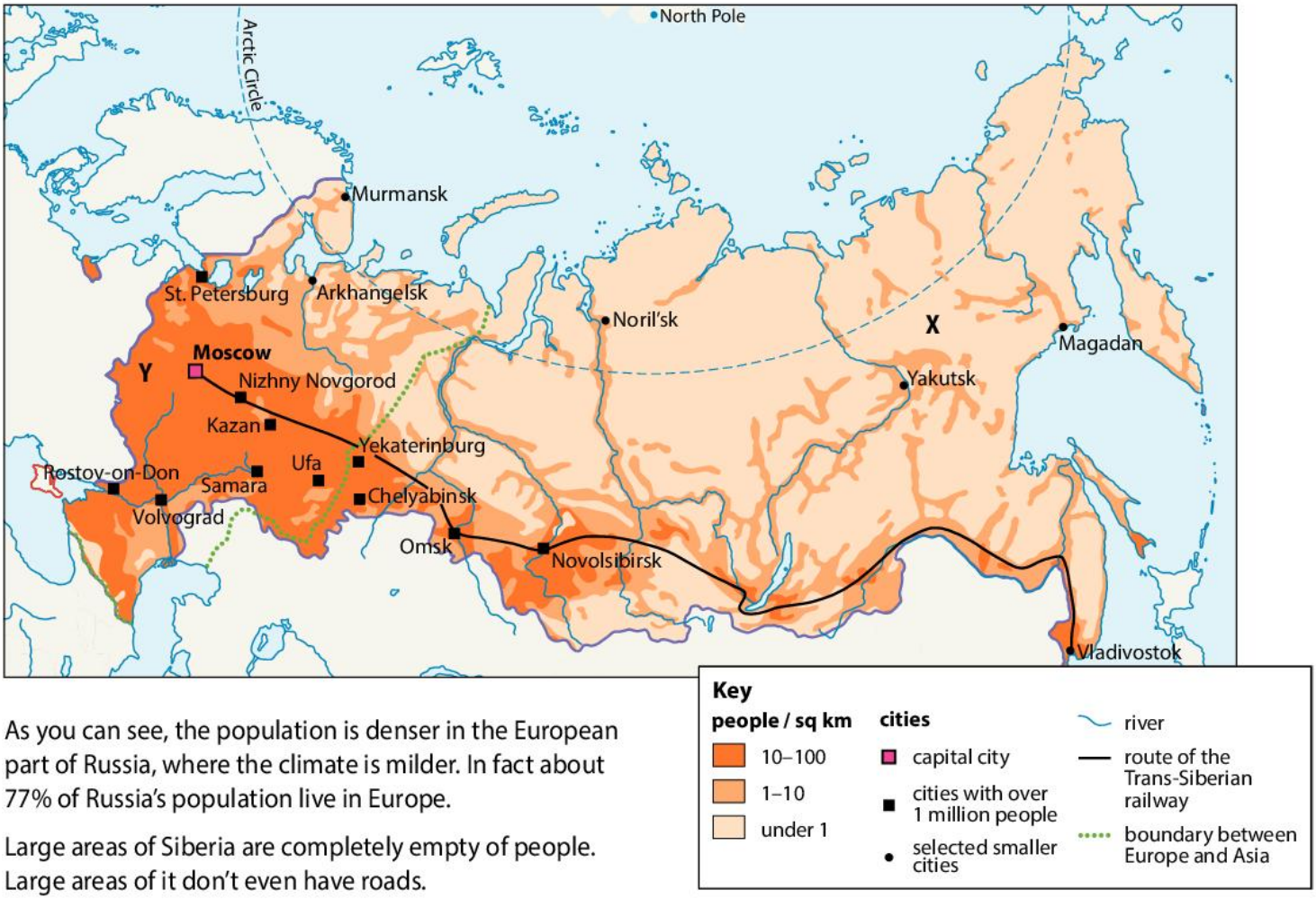
6.5 What about the people?

We have covered physical features, and climate, and biomes. Now for the people!

Top five cities (millions of people)	
Moscow	11.8
St Petersburg	5.0
Novolsibirsk	1.5
Yekaterinburg	1.5
Nizhny Novgorod	1.3

Population density in Russia

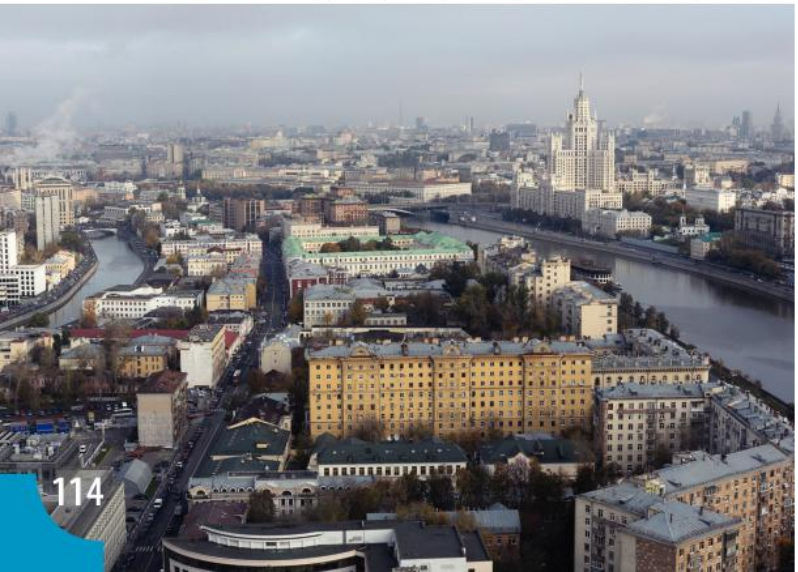
Russia has around 146 million people. This map shows how they are spread. The boundary between Europe and Asia is marked in.



As you can see, the population is denser in the European part of Russia, where the climate is milder. In fact about 77% of Russia's population live in Europe.

Large areas of Siberia are completely empty of people. Large areas of it don't even have roads.

▼ *Moscow, Russia's capital city. The big white skyscraper on the bank of the River Moskva (in right of photo) is an apartment building.*



▼ *St Petersburg, Russia's second largest city. The building with the tall spire is a cathedral. Many of the Tsars are buried there.*

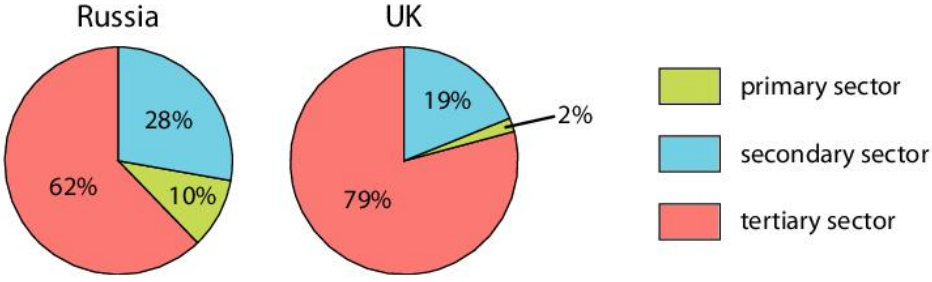
▲ *Looks familiar? The Russian language uses the Cyrillic script.*

▲ *Out in the countryside: a farmer and her dairy cow.*

The people

- The Russian Empire took over peoples with different languages, cultures, and religions. So today, Russia has over 160 different ethnic groups.
- The Russian ethnic group is the biggest – about 81% of the population say they are Russian, on census forms. The next biggest groups are the Tatars (3.9%), Ukrainians (1.4%), and Bakshirs (1.2%).
- Russia's population fell in the tough years after the USSR broke up. Now it is rising slowly again, thanks largely to immigration from other ex-USSR countries.
- Overall, 74% of the population is **urban**. (The figure is 80% for the UK.)
- What do people do for a living? These pie charts compare **employment structure** for Russia and the UK:

▲ *Religion was suppressed in the USSR. Now there's a revival. The main religion is Russian Orthodox (a Christian religion). These are priests and monks.*



Your turn

1 In which part of Russia do most people live?

2 Find **X** and **Y** on the map. What is the population density:
a at **X**? **b** at **Y**?

3 The main rivers are marked on the map.
Look for links between rivers and population density.
a Describe what you notice. **b** Then try to *explain* it.

4 The map also shows one of Russia's key transport routes: the Trans-Siberian railway.
Repeat question **3**, but this time for the railway.

5 Of Russia and the UK, which has a bigger % of people:
a in farming? **b** working in factories?

6 You plan to build a big furniture factory. You are offered a site at **X** on the map. Using all you know already, write a list of:
a advantages **b** disadvantages
of this location for your factory. Think of as many as you can.

7 Now someone offers a site at **Y**, for your furniture factory. Which will you choose, **X** or **Y**? Give *three* reasons.

8 How might global warming affect population density in Russia?

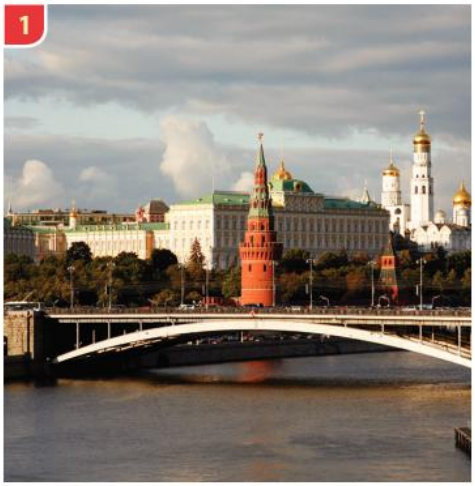
6.6 A tour of European Russia

Here you can find out more about Russia west of the Urals.
Just match the numbers on the photos to the numbers on the map.

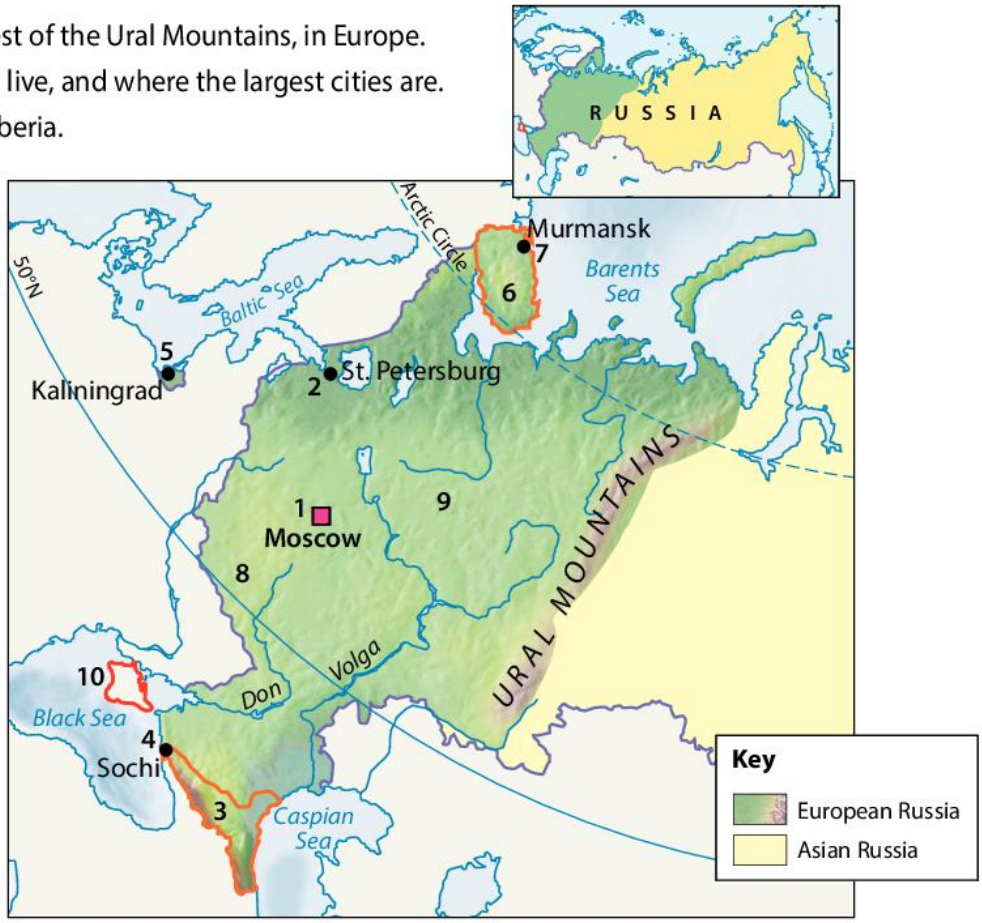
A reminder

- About a quarter of Russia's land lies west of the Ural Mountains, in Europe.
- This area is where most Russians (77%) live, and where the largest cities are.
- Overall, the climate is milder than in Siberia.

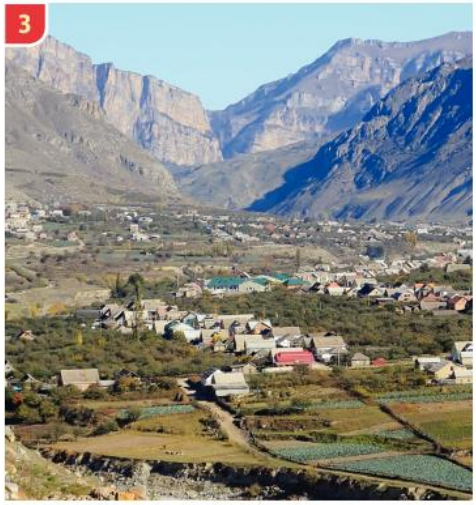
Take a tour!



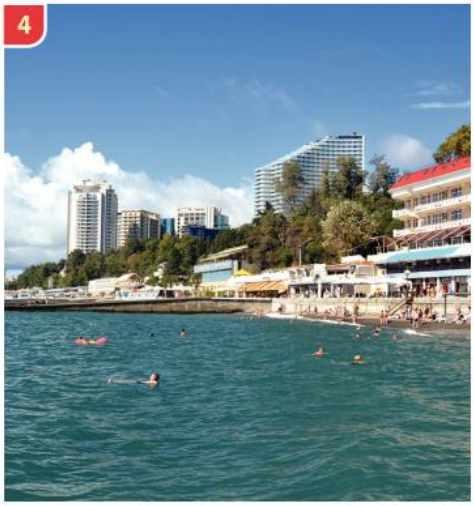
Moscow. The capital, with almost 12 million people. It has factories making cars, helicopters, textiles, and more. The big complex of buildings above is the Kremlin, where the President lives.



St. Petersburg. Russia's second largest city, with 5 million people. It has a port, and lots of industry including shipbuilding and aerospace. It has many beautiful buildings.



The North Caucasus. Largely a farming region, and largely Muslim. It includes the republic of **Chechnya**. In the past, Chechens fought for independence from Russia (and failed).



Sochi. Russia's top holiday resort. On the Black Sea, with warm summers, and mild winters. It's also a centre for football and other sports. You can ski in the nearby Caucasus mountains.

5

Kaliningrad. This exclave gives Russia the benefit of a second port on the Baltic Sea. It is also a manufacturing hub for cars, TVs, and other goods. It is smaller than Birmingham in area.

6

The Kola Peninsula. Far north, but quite mild in winter thanks to the **North Atlantic Drift**. It is highly industrial, based on mining for metals. It is heavily polluted too.

7

Murmansk. The Kola Peninsula's main city, and a port. It is ice-free in winter, which helps. It is important for fishing. It is the biggest city in the Arctic. (Noril'sk, also in Russia, is second.)

8

Farmland. There's lots. Many farms are very large, from when the state owned all the land. Crops include wheat, barley, and potatoes. The best farmland lies south of Moscow.

9

Rural villages. You'll find many villages of wooden houses on your travels. Many are in decline, because people are moving to the cities. Over time, the forest will reclaim the land.

10

Crimea. It is not legally part of Russia. It belongs to Ukraine. But Russia now controls it. (See page 106.) Sevastopol is a port and naval base. Yalta is a seaside resort.

That's just a selection of what you might see on travels around European Russia. There's much much more!

Your turn

1 Look at the photos in this unit. Which *three* places would you most like to visit? Explain your choice.

2 What and where is:
- a Chechnya?
- b the Kola Peninsula?
- c Crimea?
- d Kaliningrad?

3 Which geographical factors helped to turn Sochi into Russia's top holiday resort? (Don't forget latitude!)

4 St Petersburg port gets iced over in winter. (They use ice-breakers.) Murmansk port is in the Arctic, but ice-free. Why?

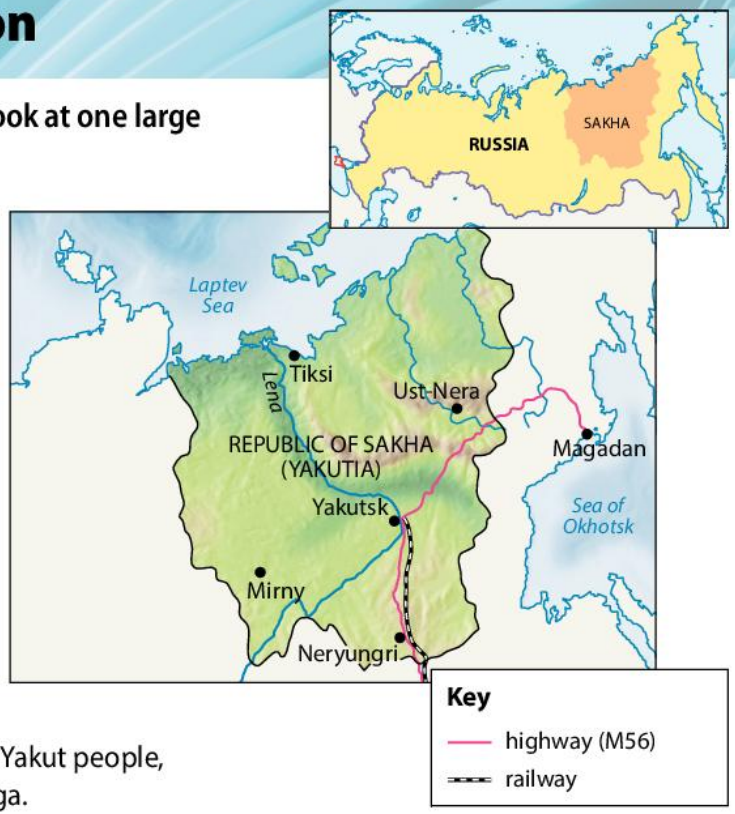
5 Look at the rural village in photo **9**. European Russia has many rural villages – but many are in decline. Suggest *three* reasons why people want to move to the cities.

6 Four ports are named in this unit.
- a List them, and say which sea or ocean each port is on.
- b For each port, try to explain its importance to Russia. (Think about where ships can go from there. Page 141?)

7 This unit is about European Russia. What kinds of landscapes might you expect to see in Asian Russia?

6.7 Sakha: Russia's biggest region

In Unit 6.6, we looked at European Russia. Now we look at one large region in Siberia.



Meet the Sakha Republic

The **Sakha Republic** is in Siberia. Look at these maps.

It is also called **Yakutia**, after the Yakuts people who have lived here for many centuries.

It is Russia's biggest administrative region: 3.1 million sq km. It covers about a fifth of Russia. It is almost as big as India (which is 3.3 million sq km).

It is also Russia's coldest region, with permafrost everywhere.

Fewer than 1 million people live there.

When the Russians arrived

The first Russian explorers arrived here in 1631. They found the Yakut people, raising horses and cattle in grassy areas dotted through the taiga.

The Russians built a wooden fort near where Sakha's capital city, Yakutsk, now stands. From there they colonised the region. They demanded furs as taxes.

Some Yakuts fled north to the tundra, to escape the Russians. There they became reindeer herders.

The Russian population grows

Sakha is a long way from Moscow. In those days, a return trip took over three years! So, not many Russians chose to move to Sakha. (But some were exiled there, because of their religious or political beliefs.)

All this began to change from the 1920s, when geologists started to explore Sakha's natural resources. They found a rich treasure trove. And today …

- Sakha produces a quarter of the world's diamonds, and 24% of Russia's gold.
- Silver, tin, tungsten, antimony and uranium are also mined there.
- Gas, oil and coal have been found – but not yet extracted.

Thanks to its resources, Sakha's population grew from around 290 000 in 1926 to about 960 000 today. About 38% are ethnic Russians. Nearly 50% are Yakuts.

A

▲ *Because it's so cold in winter in Sakha, you can buy milk as frozen discs.*

B

▶ *The Yakut still rear horses and cattle. The Yakut horses can live outdoors all year. Cattle are moved indoors in winter, and fed on hay.*

▲ *The Mir diamond mine in Sakha. It is nearly exhausted. The town is Mirny. Population 37 000, it exists because of the mine.*

▲ *Flying across the River Lena to Yakutsk. It's the only way to get there in winter, until the river ice is thick enough.*

Yakutsk, Sakha's capital city

- Population: 270 000 (about the same as Derby in the UK).
- It's the world's coldest city. The harsh winter lasts for 8 months, with average temperature –34 °C. But summers can rise to 25 °C.
- The permafrost around Yakutsk is up to 250 metres thick. Buildings are on concrete stilts, pushed deep into the ground, to stop them collapsing in summer.
- As the capital city, Yakutsk has a big problem.
  It is on the west bank of the River Lena. (Look at the map.) The highway, and railway, are on the east bank. The river is wide. And there's no bridge across it, *anywhere* in Sakha!

  In summer, ferries sail across the Lena. In winter, trucks drive across it when the ice is thick enough. When the river is only partly frozen, you need to take a plane.
- But there is hope. They intend to build a bridge 3 km long, 20 km from Yakutsk, where the Lena narrows. Building it in the permafrost will be a huge challenge.

Sakha's future

The government plans to exploit more of Sakha's resources, and improve transport links. But it must think about **global warming**. This will cause at least some permafrost to melt. Mines, transport links, and other structures will all be affected.

▲ *By December, the Lena is so deeply frozen that you can drive on it. Just like a road.*

▲ *Summer is short, and it's a long way to Sochi. This is a sandy bank of the Lena, near Yakutsk.*

Your turn

1. Look at the map on page 118. Using what you see on the map, write down *eight* geographical facts about Sakha. (For example you could mention *river*, *ocean*, *Arctic Circle*, *transport routes* …)
2. Although Sakha is sparsely populated, it very important to Russia. Why?
3. Having no bridge over the River Lena makes life difficult, for people and businesses in Yakutsk. See if you can explain why.
4. You are in charge of building the bridge over the Lena. Make a list of all the challenges you face. (For example, think about assembling what you need, working conditions, working hours, global warming, and more …)

6.8 So … how is Russia doing?

Russia has undergone much conflict and change. How is it doing now? Find out in this unit.

Russia at home

First, let's see how Russia is doing at home.

After the USSR broke up

In the USSR, the state owned everything – farms, factories, shops, most homes. Everyone had a job. You paid no rent. In theory, everyone was equal.

(But in practice, many things were badly run. Often there were shortages of food and other items.)

When the USSR broke up, and the Communist Party lost power, there was chaos. Factories and other state-owned businesses were sold. People lost their jobs. Rent was charged. Prices rose. Many fell into poverty.

It can take years for a country to recover from such changes.

▲ *Before the Soviet Union broke up, food was often in short supply.*

How are people doing now?

Today, Russia is in a new phase.

- It is formally a **democracy**. People can vote for their leaders.
- People can run their own businesses, and farms.
- People seem quite well off. Look at the table on the right.
- But those figures are *averages*. In fact, in 2012 …
  - 110 Russians held over one-third of Russia's wealth
  - at least 20% of Russians were living below the **poverty line**.
- So there is great **inequality** in Russia. (There's inequality in every country. But it is more extreme in Russia than in most.)
- Those very wealthy Russians are called **oligarchs**. They are wealthy usually because they bought factories and other businesses cheaply, when the USSR broke up. They made them profitable, and made a fortune.

Country	GDP per person (PPP) in dollars
Russia	24 100
China	11 900
UK	38 500
USA	53 000
Malawi	780

Did you know?

- Some of the UK's Premier League football teams are owned by Russian oligarchs.

▼ *Upmarket shopping in Moscow. The Russian currency is the rouble.*

▼ *They probably don't earn many roubles …*

Russia in the world

Russia has a big impact on the world. Let's look at the reasons.

- It's the biggest country by area, and 9th biggest by population. You can't ignore it!
- It shares borders with a large number of countries (14).
- It is rich in natural resources which other countries want. For example, it has the world's largest gas reserves, and 8th largest oil reserves. It pumps oil and gas to China, and into Europe. India may be next.
- Its economy has been growing quite fast. (It is in the world's top ten.)
- It has a big army. And it has nuclear weapons – but like the USA, UK, China, and France, it has agreed not to make any more.
- It has given us great scientists and mathematicians.
- It is famous for its literature, classical music, and dance.
- It is attracting more and more tourists. It had 28 million tourists in 2013.

▲ *A gas pipeline through the Siberian taiga. Heading for China?*

▲ *Russia sent the first animal into space in 1957 – a stray dog they named Laika. Sadly, she died within hours, from overheating.*

▲ *Tourists can take the Trans-Siberian railway from Moscow all the way to Vladivostok (page 114). Distance: 9259 km. Journey time: 7 days! Or you could fly there in 8 hours 15 minutes.*

▲ *Dancers of Russia's famous Bolshoi Ballet company.*

Your turn

1 When the USSR broke up in 1991, many Russians found themselves in poverty. Explain why.

2 Today, many Russians are still living below *the poverty line*. Explain the term in italics. (Glossary?)

3 GDP per person gives you an idea of how well off people are, on average. Which has a higher GDP per person?
   a Russia, or China?
   b Russia, or the UK?
   c Russia, or the USA?

4 Look at the bullet points about Russia on this page.
   a Choose the two you think matter most to Russia:
      i when deciding how to behave in the world
      ii in helping its economy to grow.
   Explain your answers.
   b Which bullet point do you think would be the most important to the British government? Explain.
   c Which one is the most interesting to you? Why?

7 The Middle East

The big picture

This chapter is about the Middle East. Here's the big picture …

- The Middle East is made up of 16 countries, and the State of Palestine.
- Islam is the main religion in the region, and Arabic the dominant language.
- A number of its countries are oil-rich.
- Overall, the region is hot and dry – but as usual, there are climate zones.
- The Middle East has suffered many conflicts … and some are still going on.

Did you know?
- The Dead Sea is so salty that no animals can live in it.
- The salty water is so dense that you can float around in it, reading a book.

Your goals for this chapter

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

- Say where in the world these are, and be able to point to them on a map:
  the region called the Middle East the Arabian Peninsula
- Name *at least* twelve Middle East countries, and their capitals. (Try for all?)
- Name, and be able to say where in the Middle East they are:
  - three big rivers, including the world's longest
  - at least three mountain ranges, and the region's highest mountain
  - the five seas and three gulfs which border Middle East countries
  - a vast empty sand desert, also known as the Empty Quarter
  - the famous shipping canal which links two seas
  - the strait that leads from the Persian Gulf
- Name, and describe briefly: the climate zones the biomes
  of the Middle East.
- Say which parts of the Middle East are the most, and least, populated.
- Give at least five geographical facts about the Arabian Peninsula.
  (The names of its seven countries count as just one fact!)
- State at least four causes of conflict in the Middle East (past and / or present).
- Explain how the conflict between Israel and the State of Palestine arose, and why it is hard to find a solution.

Did you know?
- Several countries of the Middle East have royal families (like the UK does).

Did you know?
- Camels have thick leathery patches on their knees, to protect them when they kneel in the hot sand.

What if...
- … you owned a camel?

Why...
- … do deserts have sand?

And then …

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

Your chapter starter

Look at the images on page 122. They are all from the Middle East.

Which continent do you think the Middle East is in? Are you sure?

What can you say about it, just from these images?

What contrasts can you see, in the photos?

What else do you know about the Middle East?

7.1 Introducing the Middle East

The Middle East is often in the news. Where and what is it? Find out in this unit.

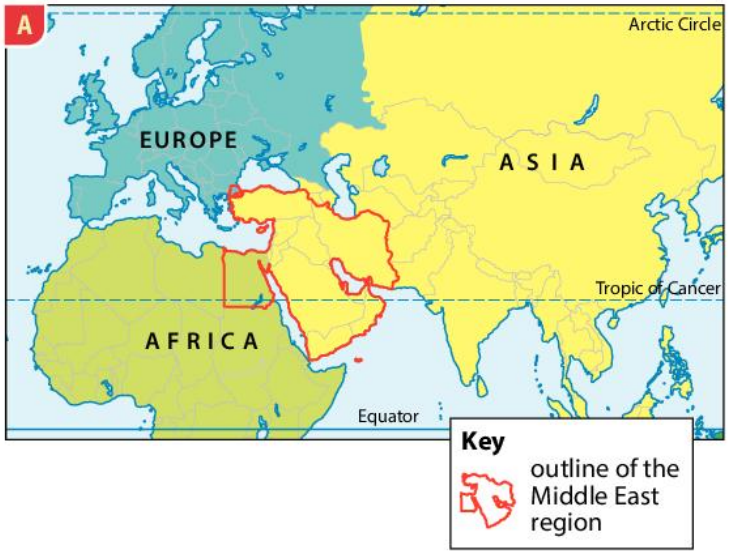
Where is the Middle East?

The Middle East is the region bordered in red on map **A**.

It is where Asia, Africa, and Europe meet.

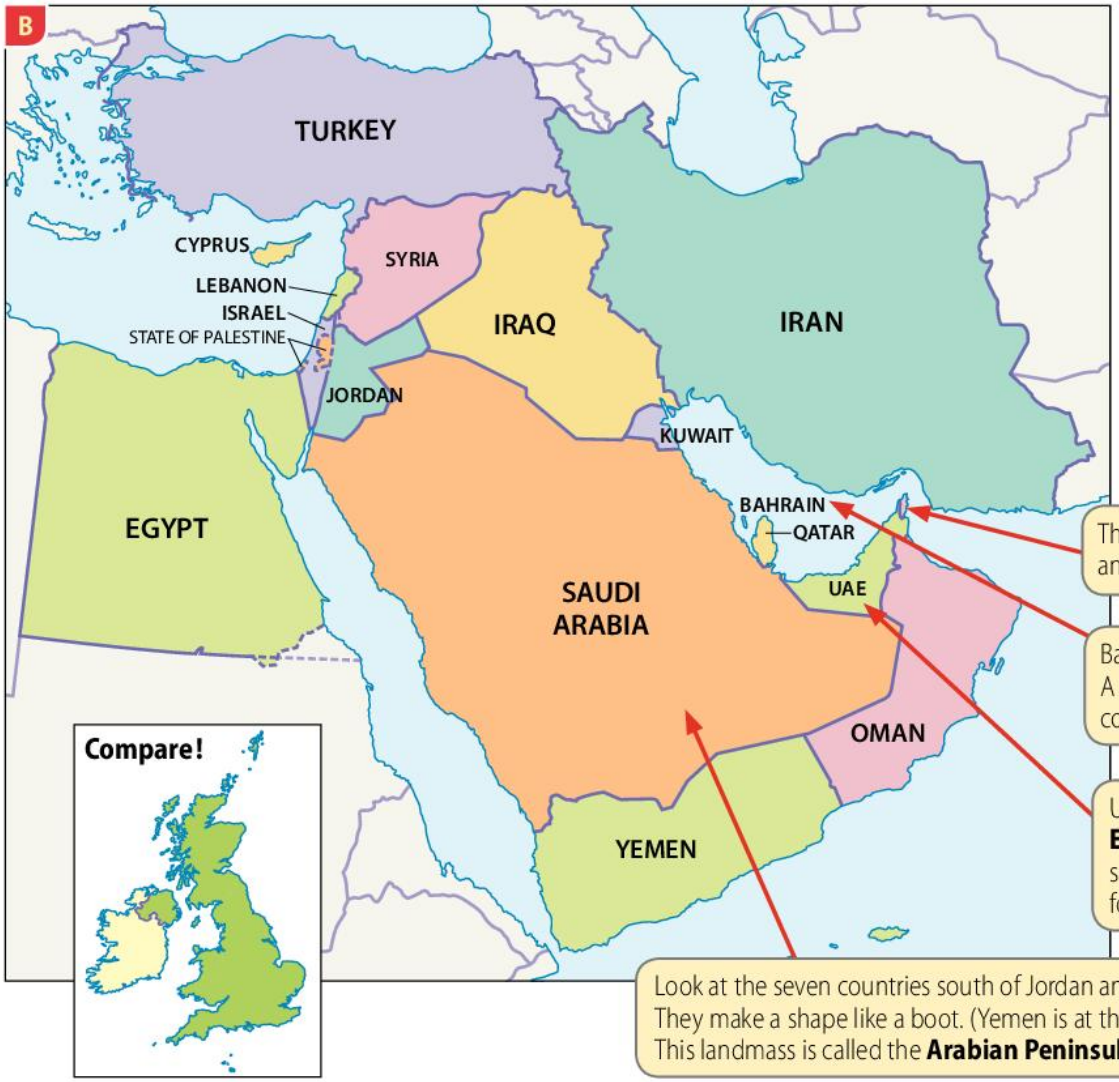
Note how it is shaped a bit like a crossroad – and largely surrounded by water.

Middle East is an odd name for this region, since most of it is in south west Asia. But the name came into use over 100 years ago, and it stuck.



The countries of the Middle East

The Middle East has 16 countries, and the State of Palestine
Look at map **B**.
(You will learn about the State of Palestine in Unit 7.7.)



▲ *The King Fahd Causeway connects Bahrain to Saudi Arabia.*

This part of Oman is an **exclave** in UAE.

Bahrain is an island nation. A causeway (shown above) connects it to Saudi Arabia.

UAE stands for **United Arab Emirates**. It is made up of seven small states, which united to form one country.

Look at the seven countries south of Jordan and Iraq. They make a shape like a boot. (Yemen is at the heel.) This landmass is called the **Arabian Peninsula**.

What's it like ?

The Middle East offers some big contrasts.

- It has large areas of desert, with very little rain.
- But you can also relax on sunny beaches – and go skiing in winter. You will even see glaciers.
- It has some fertile farmland, helped by irrigation.
- It has large oil reserves: mainly in Iran, Iraq, and the countries of the Arabian Peninsula. There is gas too.
- Three world religions began in the Middle East: Judaism, Christianity, and Islam. Today, Islam is the dominant one.
- Some of the countries are very wealthy, others poor.

▲ *Fertile farmland in Oman. Most agriculture depends on irrigation.*

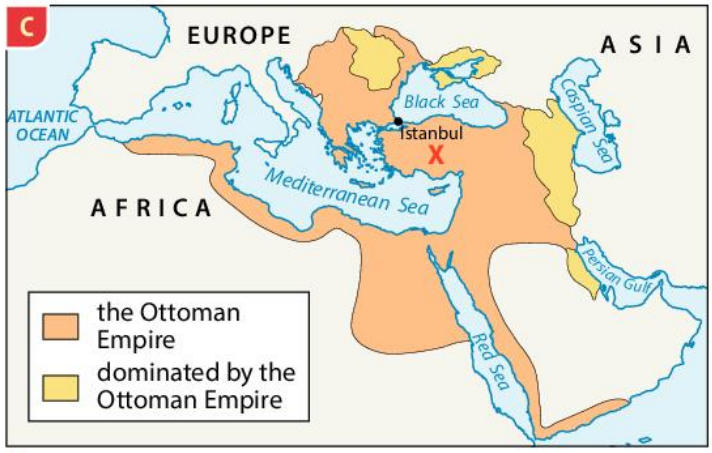
The Middle East as a region

A **region** is an area that shares a feature – such as a distinct climate, or a language, or a mountain range.

The Middle East has a long shared **history**. For example most of it was once part of, or dominated by, the Islamic **Ottoman Empire**.

Look at map **C**. The empire began around **X** in 1299, and spread. In 1453 **Constantinople** became its capital. This was the city we now call **Istanbul**.

The empire was at its peak around 1650. Then it began to decline, as empires do.

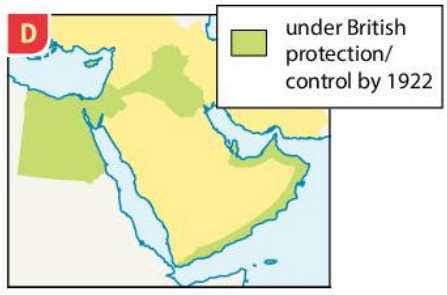


▲ *The maximum extent of the Ottoman Empire.*

The modern Middle East

By 1914 the Ottoman Empire had already lost a lot of territory, through wars. (For example, Britain controlled Egypt from 1882.) Then it entered World War I, fighting against the **Allies** (Britain, France, Russia, and others). The Allies won.

After the war, Britain and France carved up the remains of the empire between them, into areas they would control or influence. (See map **D** for Britain.) This caused much unrest in those areas. Eventually, they became fully independent.



▲ *British involvement in the Middle East.*

Your turn

1 Here are the names of some Middle East countries. You have to unjumble them!
   a EYTKRU b AYRIS c NIAR d ARQAT
   e LNBEONA f PEYGT g MEENY h MOAN

2 Look at the Middle East countries, on map **B**.
   a Which is the biggest? b Which is second biggest?
   c Which is the smallest? d Which two are islands?
   e Which border Iraq? f Which border Syria?

3 What is the *Arabian Peninsula*?

4 Straight lines were drawn on a map to create some country borders in the Middle East. Which ones? (Map **B**.)

5 See if you can name *four* Middle East countries which Britain had some control or influence over, by 1922. (Maps **D** and **B**.)

6 Describe the connection between the Middle East and the Ottoman Empire, in 45 words.

7.2 The Middle East: physical geography

Deserts, mountain ranges, seas, famous rivers, volcanoes. The Middle East region has them all. Find out more here.

Why...
- ... is it called the Red Sea?

The physical features of the Middle East

Study this map, and see how much you can discover about the Middle East. Then read the next page.

Did you know?
- The Red Sea has amazing coral reefs, where you can go diving and snorkelling.
- It has sharks too ...

Mountains

- Turkey and Iran are the two most mountainous countries of the Middle East.
- **Mount Ararat** is Turkey's tallest mountain. According to legend, it is where Noah's Ark landed, at the end of the great world flood.
- **Mount Damavand** in Iran is the Middle East's highest peak (5671 m).

▲ *Mt Damavand in Iran is the Middle East's highest mountain – and a volcano! Its last eruption was over 7000 years ago, but it still gives off steam and gas.*

Rivers

- The **Nile** is the world's longest river (6650 km). Egypt is the final country on its long journey to the Mediterranean.
- Now find the **Euphrates** and **Tigris** rivers. They rise in Turkey and flow south. They join to form the **Shatt Al Arab** before reaching the Persian Gulf.

Seas

- The **Caspian Sea**, which borders Iran, is like a huge lake, but salty.
- The **Black Sea** flows through narrow straits into the **Mediterranean Sea**.
- Look at the **Red Sea**. At the northern end is Egypt's **Suez Canal**, leading to the Mediterranean. The other end opens into the **Gulf of Aden**.
- The **Persian Gulf** opens to the **Gulf of Oman** at the **Strait of Hormuz**.
- The Gulf of Oman and Gulf of Aden lead to the **Arabian Sea**.

▲ *The Suez Canal is 193 km long. It was built to give ships a shortcut from the Indian Ocean to the Mediterranean Sea. They pay to use it.*

Deserts

- Over 90% of Egypt is desert – part of the Sahara Desert, which stretches all the way across North Africa from the Atlantic Ocean to the Red Sea.
- The **Arabian desert** covers most of the Arabian Peninsula. The **Rub' Al Khali**, or Empty Quarter, is its largest continuous stretch of sand.

Earthquakes and volcanoes

Earthquakes are common in Iran and Turkey – and there are volcanoes too. That's because several plates meet in the region, as you'll see on the map on page 89. Note that the Arabian plate is moving away from the African plate. That's why the Red Sea has volcanoes – and is slowly getting wider!

Your turn

1 a Name the Middle East's two most mountainous countries.
b In which country will you find: i the Zagros Mountains? ii the Hejaz Mountains? iii the Taurus Mountains?
c i Which is the highest mountain in the Middle East?
ii Which country is it in?

2 a List the bodies of water which border the Middle East region.
b Which two are linked by the Strait of Hormuz?

3 The Arabian Sea is part of an ocean. Which one? (Page 140?)

4 a Name the three main rivers of the Middle East.
b Saudi Arabia has no permanent rivers. Suggest a reason.

5 A canal was built at one end of the Red Sea.
a What is it called? b Which country is it in?
c Try to explain why ships are willing to pay to use it.

6 What and where is the *Rub' Al Khali*?

7 a The Red Sea is slowly getting wider. Why?
b Turkey is prone to earthquakes. Why?

7.3 The Middle East: climate zones and biomes

The Middle East is generally hot and dry. Why? And how does this affect the natural vegetation? Find out here.

The climate of the Middle East

The Middle East is hot and dry overall. Let's see why.

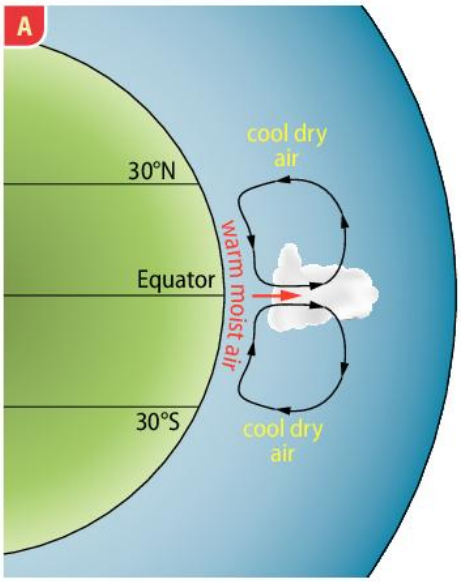
Temperature

- The Tropic of Cancer runs through the Middle East, as map **B** shows. That's why the region is hot. It's not so far from the Equator.
- But as you go up the mountains, it gets cooler. You will even find small glaciers in the mountains of Turkey and Iran.

Rainfall

And now … a mystery. The Middle East is almost surrounded by water – but doesn't get much rain. Why not? Look at diagram **A**.

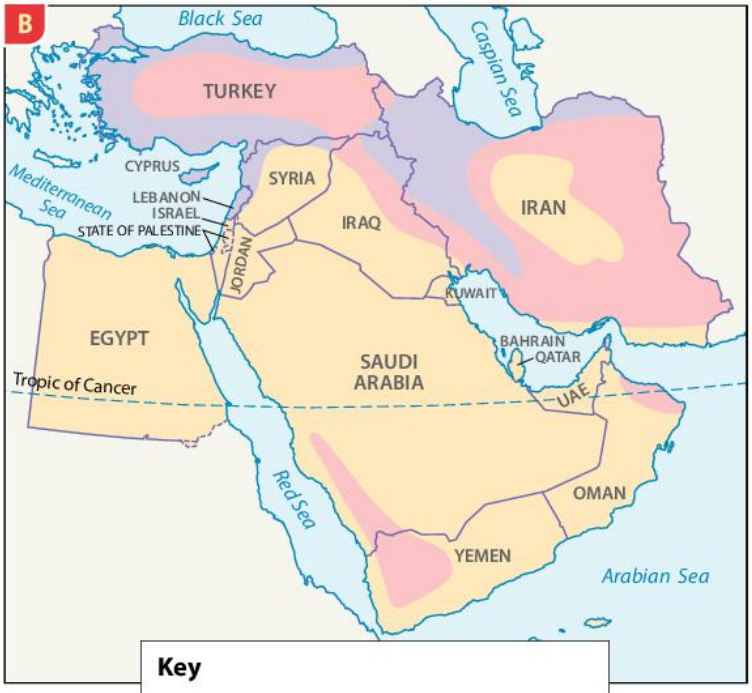
1. The land at the Equator gets hot, and heats the air. The warm moist air rises. It cools, and its water vapour condenses. So … heavy rain falls at the Equator.
2. As the warm air rises, colder air flows towards the Equator to take its place.
3. The risen air, which has lost all its moisture, gets pushed out of the way. It descends again as cool dry air around 30° north and south of the Equator. And cool dry air descending means … little or no rain.



▲ *How the air circulates between the Equator and 30° N and S.*

A climate map for the Middle East

Map **B** shows the climate zones of the Middle East.



▲ *The famous pyramids at Giza, Cairo – in an arid landscape, thanks to the rainfall at the Equator.*

Why …

- … do camels have such long eyelashes?

Did you know?

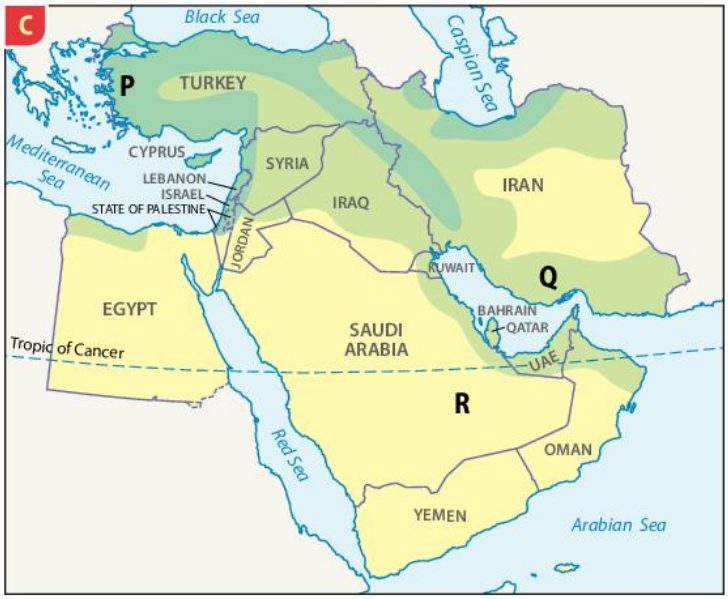
- Egypt has over 100 pyramids.
- Most were built as tombs for the Pharaohs (the rulers of Ancient Egypt).

The biomes of the Middle East

A **biome** is an area that shares similar natural vegetation, and animals. Map **C** shows the main biomes of the Middle East. Match its colours to the text boxes.

Desert and desert scrub

Vegetation is sparse. Some areas have almost none. Plants that do grow have tough spiky leaves to conserve moisture. You might see Arabian oryx, like these in the photo. And sand cats, snakes, scorpions, eagles, and more.



Grassland

These areas have grass, and some low bushes, but few trees. (They are sometimes called **steppe**.) People herd sheep and goats. Wild animals include wolves, sand foxes, wild cats, gazelles, and wild boar.

Forests and shrubland

Look at this forest of evergreen cypresses in Turkey, beside the Mediterranean. You'll also find deciduous and mixed forests. And other areas thickly covered in shrubs. You might spot bears, hyena, deer, squirrels, hamsters …

Your turn

1 Write out this paragraph about the Middle East. Fill in the blanks using terms from the white box.

The Middle East is ..... overall, because of its ..... . It is also dry, because it lies where dry air ..... , after losing ..... over the ..... . Because most places have little rain, vegetation tends to be ..... . But some places have enough rain for ..... to grow.

sparse	wind	Equator	longitude	forests	wet
latitude	hot	cold	ascends	descends	moisture

2 a Which half of the Middle East has more rain: top or bottom?
b Overall, the Middle East has a shortage of fresh water. Why?

3 Look at map **C**. See if you can explain these. (Map **B** may help.)
a Forests grow at **P** on the map, but not at **Q**.
b There is grassland at **Q**, but not at **R**.

4 You are going to the Middle East on holiday. Which climate zone will you choose? Explain why – in 35 words.

7.4 The people of the Middle East

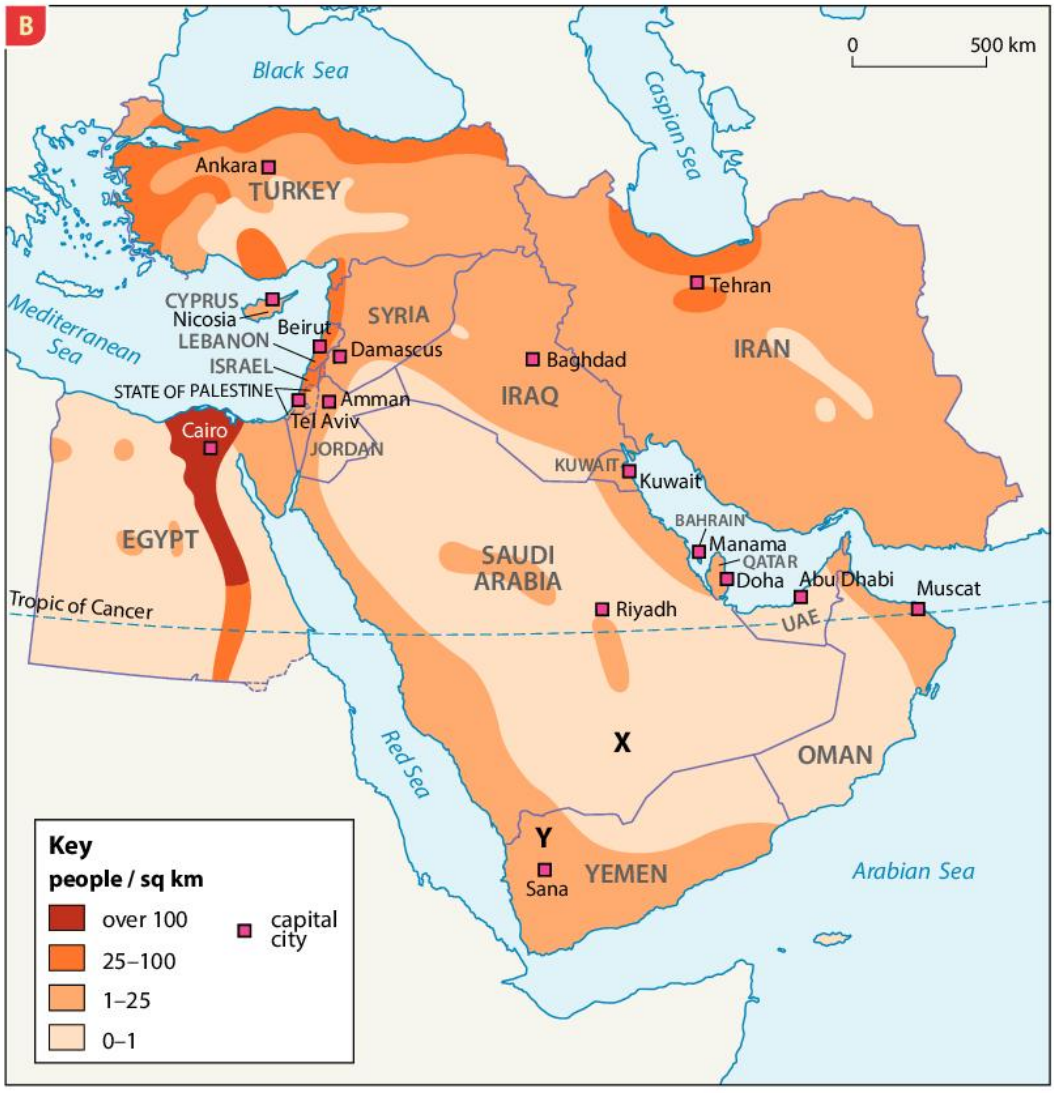
How are people spread around the Middle East? Which ethnic groups do they belong to? And which religions? Find out here!

Population

The Middle East region has around 410 million people. That's over six times more than the UK. Look at table **A**. It shows the populations, with the UK and London for comparison.

Population density

Look at map **B**. It shows the population density, and capital cities.



As you'd expect, the desert regions are almost empty.

- Look at Egypt. Most people live along the River Nile, which flows through the desert. They depend on it for water to irrigate crops.
- Now look at the Arabian Peninsula. Most of the areas of higher population density are along the coast.

A Populations in the Middle East (millions)

Egypt	88.5
Iran	78.8
Turkey	78.2
Iraq	36.6
Saudi Arabia	31.5
Yemen	26.7
Syria	23.3
UAE	8.9
Israel	8.3
Jordan	6.8
State of Palestine	4.4
Lebanon	4.3
Oman	4.2
Kuwait	4.1
Qatar	2.4
Bahrain	1.8
Cyprus	0.9
UK	64.0
London	8.6

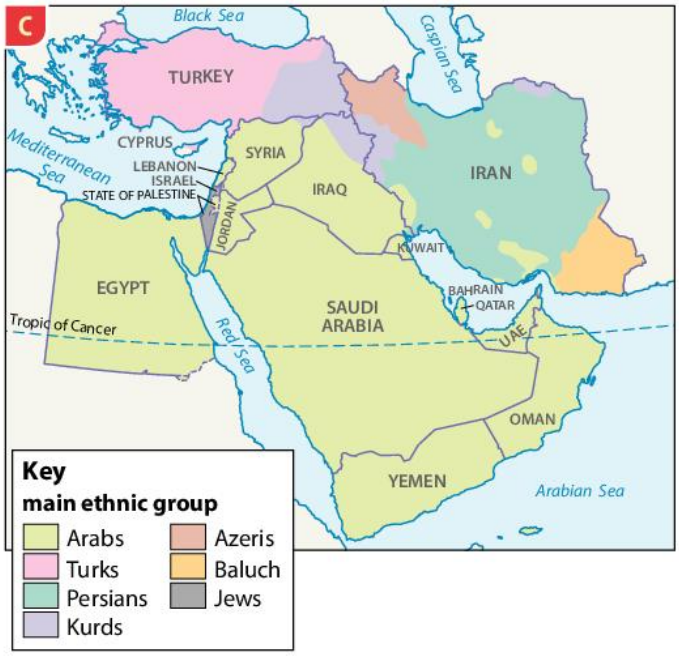
▼ *Grown in the desert, thanks to water from the Nile. The river supports most of Egypt's population.*

Ethnic groups

There are many different ethnic groups in the Middle East. The four biggest are: Arabs, Turks, Persians, and Kurds. Map **C** shows only the larger ethnic groups.

- **Arabs** are by far the biggest group. They speak Arabic. Look at the countries which are mainly Arab.
- 80% of the people in Turkey are ethnic **Turks**, and speak Turkish. Most of the rest are **Kurds**, who speak Kurdish.
- In Iran, over 60% of the people are **Persian**. There are many other ethnic groups too. Most people speak Persian.
- There are Kurds in Turkey, Iraq, Iran, and Syria. In Iraq their region is self-governing, and called **Kurdistan**. Some Kurds want all the neighbouring Kurdish regions to unite and form an independent country (to be called Kurdistan).

C



Religion

The Middle East is the birthplace of three major world religions.

- **Judaism** began in what is now Israel, about 4000 years ago.
- **Christianity** began in the same land, over 2000 years later, with the birth of Christ. (In 1 CE or 1 AD, in our calendar.)
- The rise of **Islam** began with the Prophet Muhammad, born about 570 CE in Mecca (in what is now Saudi Arabia).

Today, Judaism is mainly confined to Israel. Around 75% of the people there are **Jews**.

In Lebanon, about 40% of the population is **Christian**. Other Middle East countries have only a small % of Christians.

The large majority of people in the Middle East are **Muslim**.

▲ *The famous Blue Mosque in Istanbul, Turkey. (Blue tiles inside.)*

Your turn

1 Make a table with headings like this:

Country	Capital city

Then fill in the names of *at least* twelve Middle East countries and their capitals. Do more if you wish!

2 a For map **B**, *describe* the pattern of population density in Egypt, and then *explain* it. (Check out earlier maps too?)
b *People in the Middle East avoid living in the mountains.* True or false? Give evidence for your answer.
c With the help of earlier maps, see if you can explain why the population density is higher at **Y** than at **X**.

3 Table **A** shows the populations of the Middle East.
a Name the three *most populous* countries. (Glossary?)
b Name the three *least populous* countries.
c Name three Middle East countries:
i with larger populations than the UK
ii with between 4 and 5 million people
iii with fewer people than London

4 Which is the main ethnic group in:
a Iran? b Saudi Arabia? c Kurdistan?

5 Which is the main language spoken in:
a Iran? b Turkey? c Saudi Arabia?

6 The main religion in the Middle East is …?

7.5 A closer look at the Arabian Peninsula

Find out more about this oil-rich peninsula within the Middle East.

Did you know?

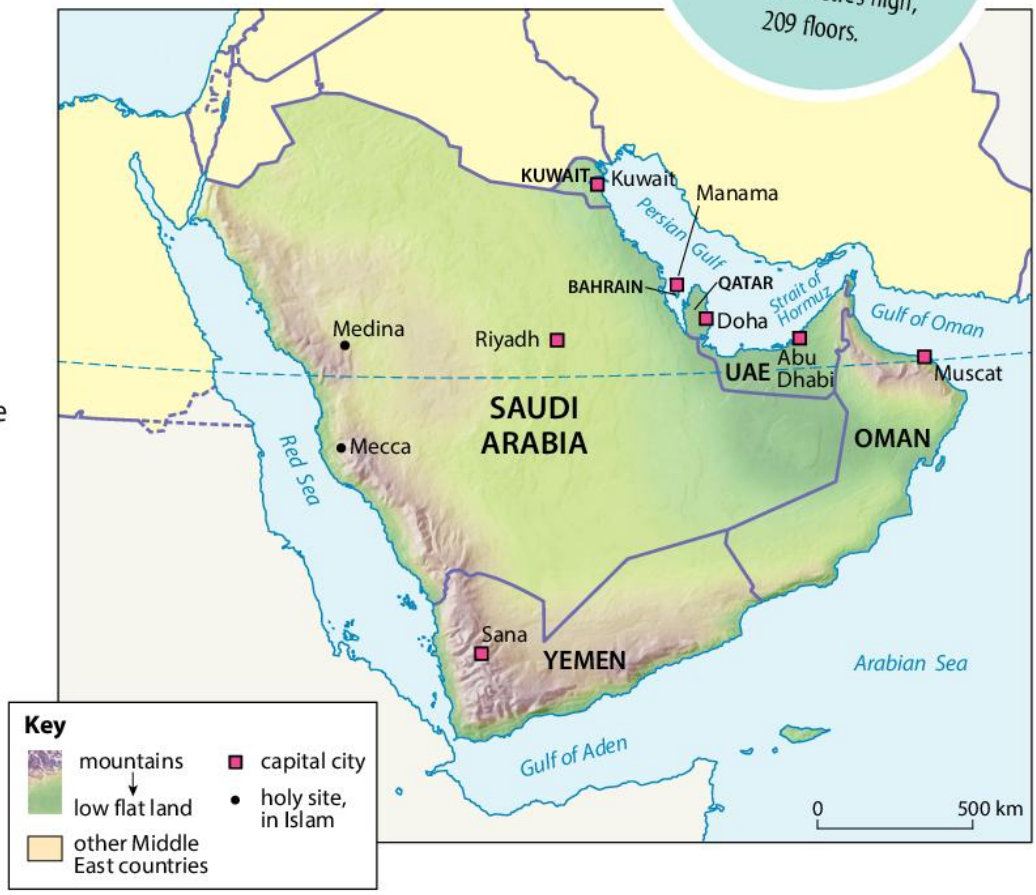
- The Burj Khalifa skyscaper in Dubai was the world's tallest building, in 2015.
- 829.8 metres high, 209 floors.

A map of the Arabian Peninsula

The **Arabian Peninsula** is the biggest peninsula in the world!

- It has seven countries.
- Note where the highest land is. In the west, it drops steeply to the low flat land along the Red Sea.
- Most of the peninsula is desert.
- But below ground there are large **aquifers** of **fossil water**.

  This fresh water reaches the surface at **oases**, or is pumped up at wells. (It will run out one day!)
- Now look at **UAE**, the United Arab Emirates. Its two biggest emirates are **Abu Dhabi** and **Dubai**. The capital is Abu Dhabi city.



What the countries have in common

The countries of the Arabian Peninsula have quite a lot in common.

A

The local people are mainly Arabs, and Muslim. But many foreigners work there – as servants, or construction workers, or in highly-paid jobs.

B

All except Yemen are **monarchies**, ruled by Kings or Emirs or Sultans. Some rulers are **absolute monarchs**, with total power over their people.

C

The **Bedouin** – a nomadic people – travelled the deserts with goats, sheep, and camels. But many have now given up this way of life.

D

Farmers grow crops in oases, and other areas with access to aquifers, or higher rainfall. This photo was taken in Yemen, which is heavily farmed.

E

100 years ago, the peninsula was poor, overall. And then … oil and gas were found. All seven countries have some. (Some have more than others.)

F

The oil and gas have made most of the countries wealthy. Qataris are the world's wealthiest people, on average! (Qatar has vast reserves of gas.)

G

The money earned from oil and gas has helped most of the countries to develop rapidly. Transport, housing, health, education – all have improved.

H

Oil and gas have also raised their status in the world. Other countries are keen to engage with them, to ensure a fuel supply.

I

But Yemen is an exception. It is poor. It does not have much oil. Its people have suffered from years of conflict, and corrupt government.

Your turn

1 Name: **a** the three smallest countries **b** the largest country in the Arabian Peninsula.

2 What do these terms mean? (Glossary?)
a peninsula **b** oasis **c** aquifer **d** fossil water

3 **a** What does *absolute monarch* mean? (Glossary?)
b Do we have an absolute monarch in the UK? Explain.

4 *GDP per person* gives us an idea of how wealthy the people in a country are, on average. Look at the table on the right.
a Only one country in the Arabian Peninsula has a GDP per person lower than the UK's. Which one?
b How many times wealthier, on average, are people in Qatar than people: **i** in the UK? **ii** in Yemen? (Try division?)

5 Why is the Arabian Peninsula so wealthy, overall?

6 The Arabian Peninsula has most of the world's *desalination plants*. (Glossary?) These are very important for its future. Try to explain why.

Country	GDP per person (PPP) in dollars, in 2013
Bahrain	43 900
Kuwait	83 800
Oman	45 300
Qatar	136 700
Saudi Arabia	53 600
UAE	59 800
Yemen	4000
UK	38 300

7.6 Conflict in the Middle East

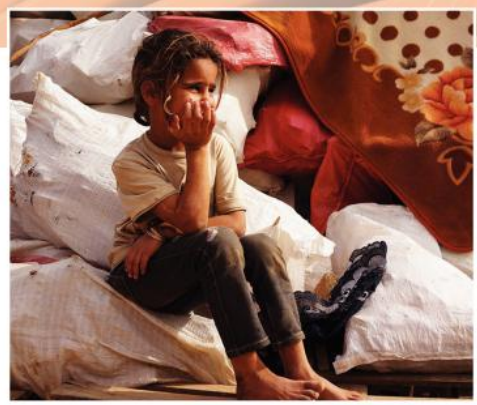
Some Middle East countries are being torn apart by conflict. Find out more here.

A region of conflict

The Middle East has long been – and still is – a region of conflict. Why? Here are some reasons:

- Borders created by Britain and France (page 125) caused some problems. Different ethnic groups were forced together – or split up, like the Kurds.
- Islam has several branches. The two main ones are **Sunni** Islam and **Shia** Islam. In some Middle East countries, most Muslims are Sunni. In others, most are Shia. Look at map **A**. (Worldwide, most are Sunni.)

  Tension between Sunni and Shia Muslims has led to violence both in and between countries.
- Many Arab countries had leaders who'd been in power for a long time, and acted like dictators. This led to a wave of unrest called the **Arab Spring**. It began in Tunisia (North Africa) in 2010 and spread to the Middle East.
- Because they need oil, foreign countries have often interfered in Middle East politics. This has caused problems.
- A long-running conflict between Israel and the Palestinians has drawn other Middle East countries into war. See the next unit.



▲ *A refugee from Syria, in Lebanon. Children are vulnerable victims of conflict.*

Islamic extremist groups

Many rebel groups operate in the Middle East. Some are **Islamic extremists**.

- **Islamic State** or **ISIS** is a Sunni militant group, with an extremely harsh interpretation of Islam. 'ISIS' stands for 'Islamic State in Iraq and Syria'.

  ISIS punishes other Sunnis for things like wearing western clothes, and voting in elections. Shia Muslims, and non-Muslims, are also the enemy.

  ISIS uses beheadings, stoning, crucifixion, and slavery as punishments. It aims to spread an Islamic state or **caliphate**.
- Another group is **Al-Qaeda**, from which ISIS sprang. It is harsh too – but less extreme than ISIS.

▶ *Fleeing from ISIS, in Iraq.*

Your turn

1 Look at map **A**. Which branch of Islam is the main one in:
  a Saudi Arabia? **b** Iran? **c** Iraq? **d** Oman?

2 **a** Many Arab countries have had *dictatorial* leaders. Explain the term in italics. (Glossary?)
  b What was the *Arab Spring*, and what caused it?
  c Name one country where Arab Spring protests led to civil war.

3 **a** What is *ISIS*?
  b Several Muslim countries have fought ISIS. Suggest reasons.

4 **a** What does the term *development* mean? (Glossary?)
  b Conflict is holding back development, in many Middle East countries. See if you can explain why.
  You can give your answer as a spider map – or write it in 50 words.

Some trouble spots

The information below goes up to early 2015. (You could do your own research to see what's happening now.)

Match the colours on map **B** to the colours in the text boxes.

Israel and the State of Palestine

There has been conflict in this region for over 100 years. You can find out why in the next unit.

Lebanon

A civil war (1975 – 1991) left Lebanon in bad shape. It was occupied by Syria, and invaded by Israel, during that time. There are still skirmishes between Israel and an Islamic group in Lebanon.

Turkey

The government has fought with Kurdish rebels, on and off, for over 30 years. They want self-rule for the Kurdish people.

Iraq

In 2003, forces led by the USA and UK invaded this oil-rich country. They said Saddam Hussein, the leader, had weapons which were a danger to the world. (These were never found.)

The invasion led to chaos. When the war ended in 2011, Al-Qaeda was flourishing in Iraq, and ISIS had formed.

In 2015, ISIS were in control of part of Iraq. The Iraqi army were fighting back, with help from the USA, UK, Jordan, Iran, and other countries.

Iran

Iran was at war with Iraq for 8 years, from 1980. But in 2014 it began to help Iraq fight ISIS. Meanwhile, Iran and Israel are sworn enemies.

The Arab Spring

The Arab Spring affected all the countries in orange, to some extent. People took to the streets to demand more freedom, an end to corruption, more jobs …

In Egypt and Yemen, dictatorial leaders were toppled. Those countries were left in a fragile state.

The other countries in orange are monarchies. The monarchs clamped down on protest, and promised reform.

Syria

The Arab Spring reached here in 2011. Protesters wanted the president to go. (His family had held power for over 30 years.)

He responded with violence, which led to civil war.

By January 2015, over 220 000 Syrians had been killed. Over 3 million had fled to neighbouring countries. And ISIS had control of part of Syria (as well as part of Iraq).

7.7 Israel and the State of Palestine

Here we look more closely at one conflict in the Middle East.

Neighbours … and enemies

Look at map **A**. It shows **Israel** and the **State of Palestine**. The borders between them have not yet been agreed. This has caused bitter conflict, and much bloodshed.

A little history will help you understand the problem.

The background

- There were Jewish people here from around 1250 BC. The Bible refers to this land as promised to them by God.
- But in 133 AD, when the area was part of the Roman Empire, the Jews were banished, after a revolt.
- In the 7th century the land – already known as Palestine – was invaded, and became part of a Muslim Arab empire. In 1516, it became a province of the Ottoman Empire.
- Jews still thought of it as their 'Promised Land'. And in the 19th century, some fled here to escape persecution in Europe.
- At the outbreak of World War I, the area was still only lightly populated, with under 600 000 people. Most were Muslim Arabs.

After World War I

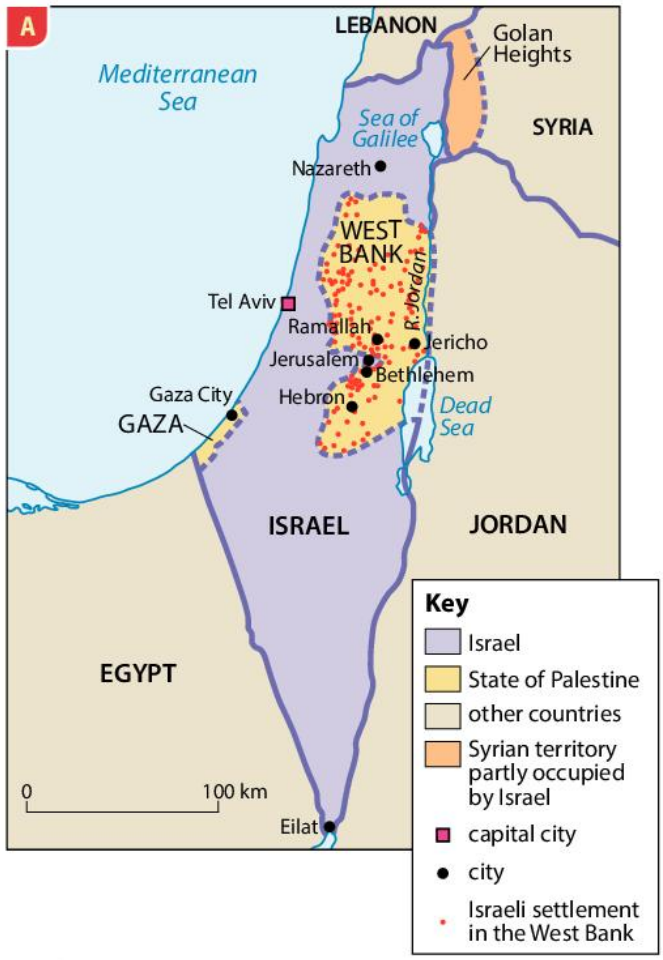
- The Ottoman Empire was defeated in World War I, and Britain took control of Palestine. It promised Jewish people a homeland there.
- Over 300 000 Jews arrived in the years after the war. The Arabs resented this. There were violent clashes.

The State of Israel is set up

- In 1947, the United Nations came up with a plan to end the conflict: divide Palestine into two states, one for Jews and one for Arabs. Map **B** shows the plan. (56% of the land would be for Jews.)
- The Arabs did not agree to the plan. The Jews did, and the state of **Israel** was set up in 1948. More Jews from other countries arrived to live there.

The conflict continues

- Other Arab countries sided with the Palestinian Arabs, against Israel.
- The day after it was set up, Israel was invaded by forces from Egypt, Jordan, Syria, and Iraq. This was the start of the **1948 Arab-Israeli war**.
- By the end of that war, nearly ten months later, Israel had gained control of a much greater area. Compare the borders in maps **B** and **A**.
- The **Six-Day war** in 1967 involved Israel, Egypt, Jordan, and Syria. By the end of that war, Israel had captured Gaza and the West Bank too. It began building settlements in them, to strengthen its control.



▲ *The division proposed by the UN in 1947.*

Today

Today Israel is accepted as an independent country, by the United Nations. But the State of Palestine is not – partly because its borders are not yet agreed.

The State of Palestine is made up of **Gaza** and **the West Bank**. Its population is about 4.4 million. The population of Israel is about 8.3 million.

Gaza

Look at Gaza on map **A**. Israel agreed to withdraw from Gaza in 2005. But it controls the border with Gaza, the sea off Gaza, and the air space above Gaza. Israel says this is to prevent attacks from Gaza. Gaza says it is being strangled.

The West Bank

Israel now has around 130 settlements in the West Bank. (Look at the red dots on map **A**.) Some settlements are large, some small.

By 2015, more than 350 000 Israelis were living in these settlements. Under international law, the settlements are illegal. Most countries condemn them.

The search for peace

There have been many attempts to resolve the conflict. By 2015, no solution had been found. Israeli settlements in the West Bank, and the status of Jerusalem, are two big sticking points.

▲ *Over the decades, the conflict drove hundreds of thousands of Palestinian Arabs from their homes. Some fled to neighbouring countries: Jordan, Syria, Lebanon.*

Jerusalem, a divided city

Look at Jerusalem on map **A**. It is a holy city for Jews, Christians, and Muslims. All three religions have important sites in Jerusalem.

Today, Israel controls Jerusalem, and claims it as its capital city. The Israeli government is based in Jerusalem. But other countries reject Israel's claim. They have their embassies in Tel Aviv, which they consider the capital.

The Palestinians want East Jerusalem as *their* capital, in any peace deal.

▶ *An Israeli settlement in the West Bank. Note the concrete fence and look-out post.*

Your turn

1 Why did Jewish people want to set up a homeland in Palestine? Give *two* reasons.

2 Look at map **B**. It shows the UN plan for dividing Palestine.
- a The plan tried to share the coastline fairly. Explain why this would be important for both states.
- b See if you can explain why the Palestinian Arabs refused to accept the plan.

3 How did this affect the territory of the Palestinian Arabs?
- a the 1948 Arab-Israeli war
- b the Six-Day war

4
- a Why did Israel build settlements in the West Bank?
- b How do you think Palestinians feel about the settlements?
- c What is the international opinion on the settlements?

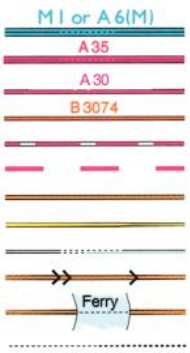
5 How do you think Israelis feel about being almost surrounded by Muslim countries?

6 Palestinians are unhappy that Israel controls Jerusalem and claims it as capital. Explain why.

7 The State of Palestine is in two parts. What difficulties might this cause for its people? List as many as you can.

Ordnance Survey Symbols

ROADS AND PATHS 1: 25 000



Motorway
Dual carriageway
Main road
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 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

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
Castle Non-Roman
Battlefield (with date)
Visible earthwork

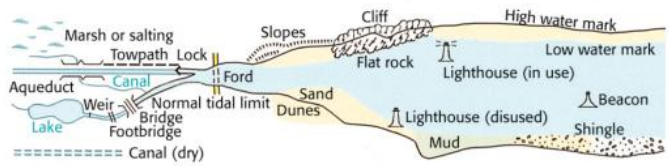
LAND FEATURES 1: 25 000 and/or 1: 50 000

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

Parking
Visitor centre
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



Map of the British Isles

Map of the world

— international boundary
• capital city

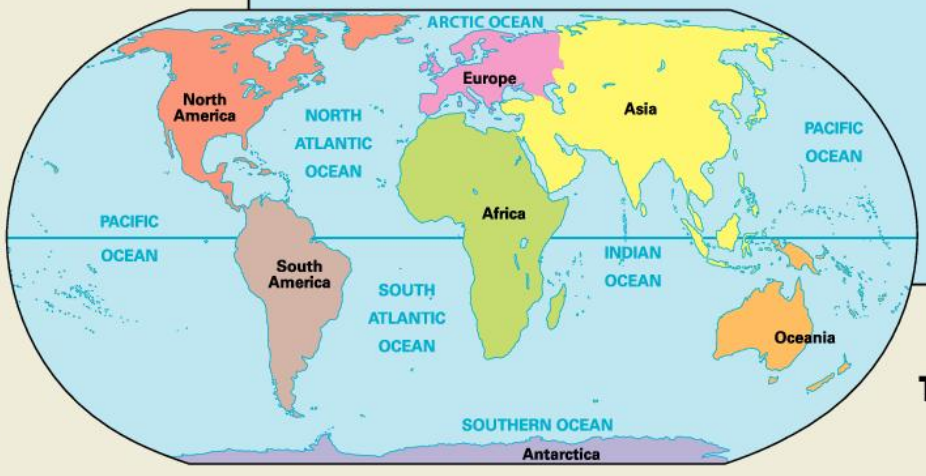
abbreviations

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.



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

absolute monarch – a monarch who has absolute power over his or her people; monarchs with no real power are called constitutional monarchs

absolute poverty – where people are so poor that they can't meet basic needs, for example for food

add value – process something in a way that increases its value; so you can charge more

adult literacy rate – the % of the population aged 15 and over who can read and write a simple sentence about everyday life

altitude – height of a place above sea level

amphibians – a class of animals which breed in water, and can breathe through their skin (as well as lungs); it includes frogs and newts

aquifer – a natural underground rock structure, which holds groundwater

Arab Spring – a wave of unrest and protests which began in Tunisia (North Africa) in 2010, and spread to other Arab countries

arid – very dry; receives little or no rain

B

biodiverse – has many different species of plants and animals

biological weathering – the breaking up of rock by plant roots and burrowing animals

biome – a very large area with a similar climate, plants, and animals

C

cash crop – a crop you grow for sale

chemical weathering – rock is broken down by chemical reactions, for example with water

climate change – all aspects of climate are changing because Earth is getting warmer

climate zone – a large area with roughly the same climate throughout (so usually has the same natural vegetation, and animals, too)

commodities – agricultural produce, and natural materials, taken from Earth and sold in bulk; for example coffee, iron ore, oil

compacted (soil) – trampled so that its pores close up and the air is driven out; plants can't grow because roots need space and oxygen

conflict – serious disagreement, which may lead to violence and even full-scale war

coniferous – describes trees which bear cones (such as pine trees)

convection current – a current of warmer material; when soft rock is heated from below, the warmer rock rises as a current

corruption – dishonest conduct by people in official positions, usually to make themselves richer; for example they may accept bribes

D

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

desalination plant – where seawater is turned into fresh water which 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, usually through misuse

developed (country) – has a wide range of services, good infrastructure, little poverty, and people have the chance to work

developing (country) – people are poor, on average, and lack many services (but the country will develop over time)

development – a process of change to improve people's lives

development indicator – a piece of data that helps to show how developed a country is

dictatorial – keeps tight control over the people, so they have little freedom

drylands – regions that don't get much rain, and rain that falls may evaporate quickly

E

earthquake – the shaking of Earth's crust, caused by sudden rock movement

economic – about money and business

economic migrant – a person who moves in order to find paid work, or to earn more

economy – all the business activity going on in a country, in producing, supplying, and consuming goods and services

employment – the state of having paid work

employment structure – the percentage of the workforce in each sector: primary, secondary, and tertiary

endangered – when so few of a species are left that it is in danger of extinction

environment – everything around you; air, soil, water, animals, and plants form the natural environment

erosion – the wearing away of rock, stones and soil by rivers, waves, wind, or glaciers

exclave – part of a country that's cut off from the main part; you have to cross the territory of another country (or countries) to reach it

exploit – to make use of a place, or people, or things, for your own benefit

export – sell things to other countries

extreme poverty – where people are living on less than $1.25 a day

F

fault – a crack in rock, where blocks of rock can move, relative to each other

fertilisers – substances added to soil to make it more fertile; they can be chemicals made in factories, or materials such as animal manure and rotting vegetation

fold mountain – formed by plates pushing into each other; the rock at the plate edges gets folded upwards, making mountains

footloose – not tied to a particular location

foreign policy – how a country deals with other countries

fossil fuels – coal, oil, natural gas

fossil water – groundwater that has been sealed into aquifers for thousands or millions of years, by changes in rock structure

fresh water – naturally-occurring water that's not salty, for example the water in rivers; seawater is not fresh water

fuels – thing we use to provide energy, usually by burning them; we don't burn nuclear fuel

fumarole – a vent or opening in Earth's crust which emits steam and gases

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

geyser – a spring of water which shoots into the air every so often; hot rock below ground heats it, and the pressure builds up

globalisation – the way the world is becoming more interconnected; it is getting easier to do business all over the world, and move goods and people and money around

global warming – the rise in average temperatures around the world

goods and services – goods are physical objects (such as pens, and cars); services are actions carried out to meet needs (such as teaching or advising people)

groundwater – water that collects below ground, when rain trickles down through the soil

gulf – an area of ocean which is partly enclosed by land; for example, the Persian Gulf

H

human geography – about how and where we humans live

hydroelectricity – electricity generated when flowing water spins a turbine

I

igneous rock – forms when melted rock hardens

illegal immigration – entering a country to live in it without a valid permit or visa

import – buy in things 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 in the UK, and factories built

inequality – when wealth and access to services are not shared equally

infrastructure – facilities such as roads, water supply, electricity supply, railways

irrigate – to water crops

L

landlocked – surrounded by land, with no ocean coastline

latitude – how far a place is north or south of the Equator; it is measured in degrees

lava – melted rock at Earth's surface

life expectancy – how many years a new baby can expect to live for, on average

longitude – how far a place is east or west of the Prime Meridian; it is measured in degrees

M

magma – melted rock below Earth's surface

magnitude – how much energy an earthquake gives out (measured on the Richter scale); greater magnitude means greater damage

manufacturing – making things in factories

mass extinction – when a large number of species die off over quite a short period of time; for example because of an ice age

metamorphic rock – forms when rock is changed through the action of heat and / or pressure, without melting.

migrant – a person who moves somewhere else, usually to find work, or a better life

mineral – a natural compound in rock; rock is a mixture of different minerals

multinational corporation – a big company with branches in different countries; examples are Apple, Nike, Nissan, Shell

N

natural – occurs without human involvement

natural resource – it occurs naturally in the environment, and we can make use of it; for example wind, and oil

NGO (non-governmental organisation) – a charity (such as Oxfam) which helps people, and is independent of the government

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 flows up to the Arctic

nutrients (for plants) – substances which plants must take in, to grow and be healthy

O

oasis – a fertile area in a desert, where there is a well or spring (so crops can be grown)

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

physical geography – about Earth's natural features (mountains, weather, and so on)

physical weathering – weathering which breaks rock into smaller bits

plateau – an area of fairly flat high land

plates – Earth's hard outer part is broken into big slabs called plates, which move around

population – how many people live in a place

population density – the average number of people living in a place, per square kilometre

populous – has a large population

poverty line – the minimum amount of money you need, to obtain the basic essentials for living (enough food, fuel, and so on)

precipitation – water falling from the sky (as rain, sleet, hail, snow)

primary sector – the sector of the economy where people collect things from Earth; farmers and miners are in this sector

Q

quaternary sector – the sector of the economy where people use high-level expertise to develop things to help other sectors

R

rainforest – has lush vegetation, with many different species of plants and animals

refugee – a person who has been forced to flee from danger; for example from war

relative poverty – where people are poor compared to the average in their society (but have enough to live on)

relief – how the height of the land varies

renewable resource – a resource that nature continues to provide (such as sunlight) or that we can grow more of (such as wood)

republic – does not have a monarch

resources – things we need to live, or use to earn a living; for example food, fuel

Ring of Fire – the ring of volcanoes that circles the Pacific Ocean

rural (population) – living in the countryside

S

sediment – a layer of material (stones, sand, mud) deposited by a river, or the wind

sedimentary rock – formed from sediment; sandstone is formed from a sediment of sand

secondary sector – the sector of the economy where people build things and make things, for example in factories

settlement – a place where people live; it could be a hamlet, village, town or city

social – about people and society

solar cell – converts sunlight into electricity

solar power – electricity generated from sunlight, using solar cells

sparsely populated – not many live there

standard of living – the level of goods, services, and comfort available to people

steppe – a large flat area of treeless grassland

structure of employment – the percentage of the workforce in each sector (primary, secondary, tertiary)

T

taiga – region of coniferous forests which lies between the tundra and steppes

temperate – relating to a mild climate: not too hot, not too cold

tertiary sector – the sector of the economy where people provide services for other people; for example healthcare

tree line – the line or altitude above which it's too cold for trees to grow

tsunami – waves generated by an earthquake in the ocean floor

tundra – a cold region where the ground is deeply frozen; only the surface thaws in summer, allowing small plants to grow

U

under-5 mortality rate – the % of babies born alive who die before age 5

unemployed – has no paid work (but wants it)

unemployment – when people are looking for paid work, and can't find it

urban (population) – living in towns and cities

V

volcano – where lava erupts at Earth's surface

W

weathering – the breaking down of rock, by the action of things in its environment: heat, cold, rain, plant roots, and so on

world wide web – the network of websites, which you can access using a web browser

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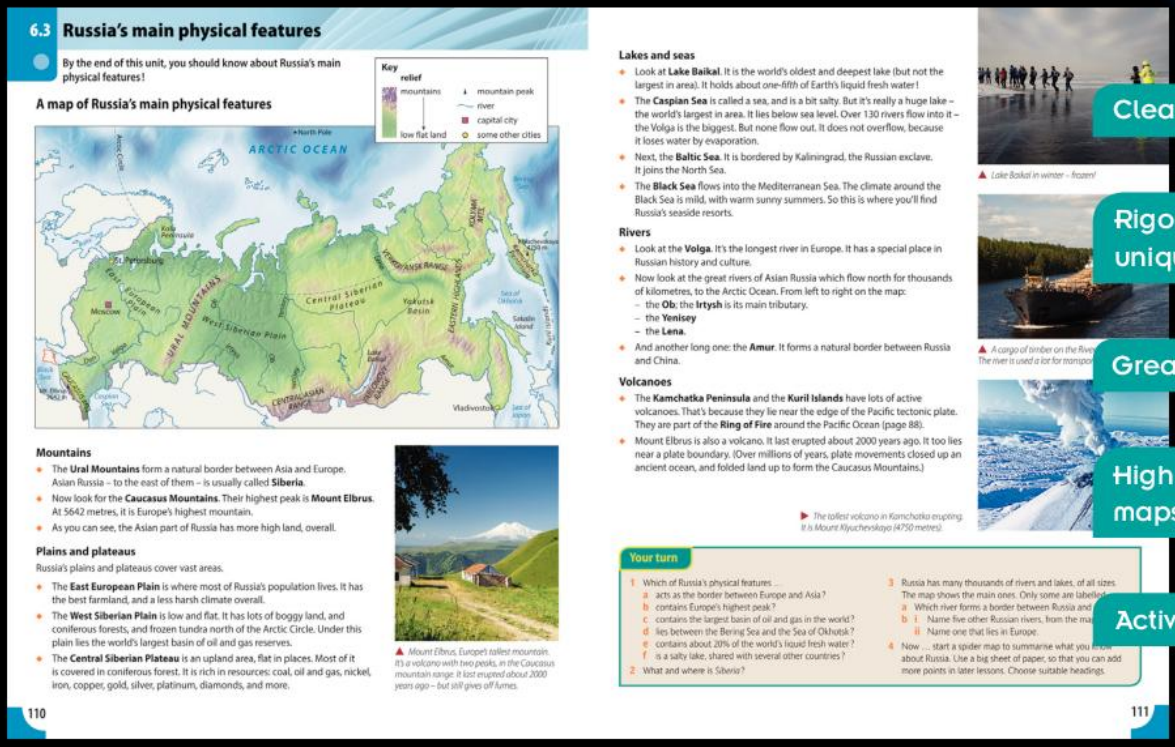

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