



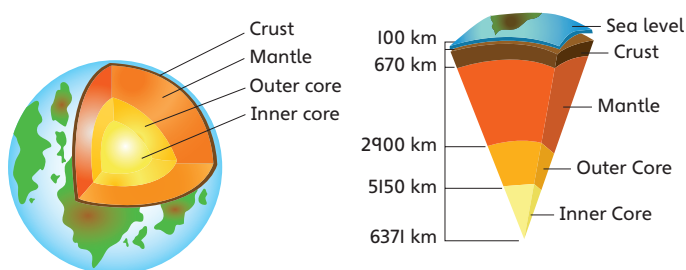
Primary Geography

Mountains, volcanoes and earthquakes

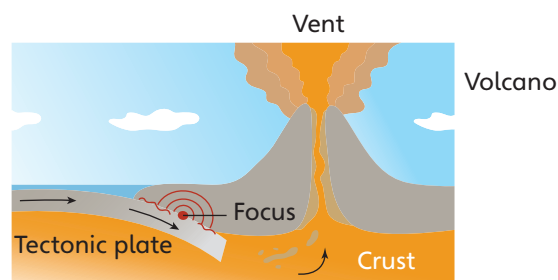
Name:

Class:

Knowledge organiser



Layers of the Earth



Earthquakes occur when plates jolt forward after getting stuck

Volcanoes erupt when magma rises to the surface



A shield volcano



A stratovolcano

Structure of the Earth	
Crust	Solid rock, 0–70 km thick; continental (granite) and oceanic (basalt); made up of tectonic plates
Mantle	Solid rock, approx. 2,900 km thick
Outer core	Liquid metal: iron and nickel; approx. 4,500 °C
Inner core	Solid metal: iron and nickel; approx. 6,000 °C

Rocks and metals	
Granite	A type of rock formed by cooled magma; granite is the most common rock on the continental crust
Basalt	A type of rock formed by cooled magma; basalt is the most common rock on the oceanic crust
Iron	A type of metal; iron is the most common metal on Earth
Nickel	A type of metal

Vocabulary	
Epicentre	The point on the Earth's surface directly above the focus. An earthquake is felt most strongly at the epicentre.
Focus	The point deep underground where an earthquake starts
Fold mountain	A mountain created when tectonic plates collide and cause the plates to wrinkle upwards
Friction	A force between two things that are trying to move past each other
Lava	Magma that has reached the Earth's surface
Magma	Molten (melted) rock beneath the Earth's surface
Moment magnitude scale	A scale from 1–10 to measure the strength of earthquakes
Pressure	A physical force created when solid things push against each other, or when gasses build up inside something and push against the sides
Seismic waves	Waves of energy created by an earthquake that travel through the Earth
Tectonic plates	Large sections, or plates, that make up the surface of the Earth

Volcanoes	
Shield volcano	Largest volcanoes on Earth; wide base, low height Example: Kilauea (Hawaii) and Erta Ale (Ethiopia)
Stratovolcano	Most of the world's volcanoes are stratovolcanoes; high with steep sides Example: Mount Vesuvius (Italy) and Barðarbunga (Iceland)
Active volcano	A volcano that has erupted at least once in the last 10,000 years and still shows some signs of activity, such as movement of the plate beneath it, or gasses being released into the air
Dormant volcano	A volcano that has erupted in the last 10,000 years but is not showing signs of activity; however, it is expected to erupt again at some point
Extinct volcano	A volcano that has not erupted in the last 10,000 years and shows no signs of activity

4 Learning review

Lesson number	Lesson question	You will learn...	Learning review
1	What is the Earth made of?	<ul style="list-style-type: none"> • What the four main layers of the Earth are. • What the different types of crust are. • Where the major tectonic plates are. 	<hr/> <hr/> <hr/>
2	How are mountains and volcanoes formed?	<ul style="list-style-type: none"> • What fold mountains are. • What the two types of volcanoes are. • Where volcanoes are located. 	<hr/> <hr/> <hr/>
3	How do earthquakes and volcanic eruptions happen?	<ul style="list-style-type: none"> • How earthquakes happen. • How volcanoes erupt. • Why we don't have earthquakes or volcanic eruptions in the UK. 	<hr/> <hr/> <hr/>
4	What are the effects of earthquakes and volcanic eruptions?	<ul style="list-style-type: none"> • What people can do to deal with earthquakes. • What people can do to deal with volcanic eruptions. • What the immediate and secondary effects of earthquakes and volcanic eruptions are. 	<hr/> <hr/> <hr/>
5	Do the benefits of living near a volcano outweigh the risks?	<ul style="list-style-type: none"> • What the benefits of living near a volcano are. • What the risks of living near a volcano are. 	<hr/> <hr/> <hr/>
6	Assessment: Imagine you are in charge of a town. How would you plan for a volcanic eruption?		<hr/> <hr/> <hr/>

Lesson 1

What is the Earth made of?

Structure of the Earth

The Earth is the shape of a ball, or sphere. It is made up of four layers: the inner core, outer core, mantle and crust.

The inner core

The inner core is at the centre of the Earth. It is a solid mix of metals called iron and nickel. The temperature of the inner core can reach about 6,000 °C. The hottest summer days in the UK can be around 30 °C. So, the inner core is about 200 times hotter than that!

The outer core

The outer core is a liquid layer. It is also made up of a mix of iron and nickel. The outer core is slightly cooler than the inner core at about 4,500 °C.

The mantle

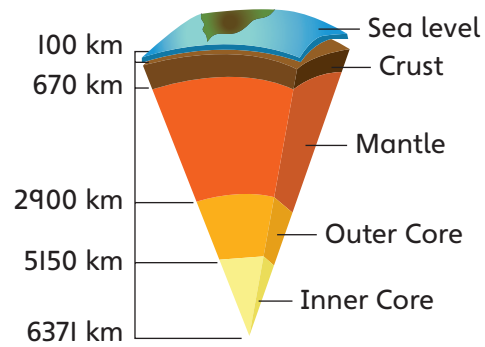
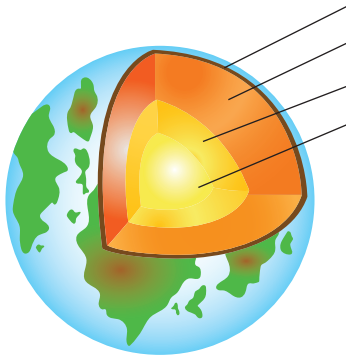
The mantle is made of solid rock that flows very slowly. The average temperature of the mantle is 2,500 °C.

The crust

The crust is made of solid rock, such as granite and basalt. There are two different types of crust.



1. What are the four layers of the Earth? Label the diagram.



Oceanic crust

The oceanic crust forms the sea floor. It is up to 11 km thick and made of volcanic rock. In some places the oceanic crust is pulling apart, allowing the mantle to rise up and make new oceanic crust. The oldest oceanic crust is only 200 million years old – quite young for rocks!

Continental crust

The continental crust forms large areas of land. It can be up to 70 km thick in places and is made of different types of rock. Some of these rocks are 4 billion years old! The rocks in the continental crust are not renewed like the rocks in the oceanic crust.



2. Fill in the blanks to complete these sentences about the different types of crust.

The two types of crust are called _____ and _____.

The older crust is the _____ crust.

The sea floor is made of _____ crust.

Tectonic plates

The Earth's crust is made up of large pieces called **tectonic plates**, which move around on top of the mantle. Tectonic plates can contain both continental and oceanic crust.

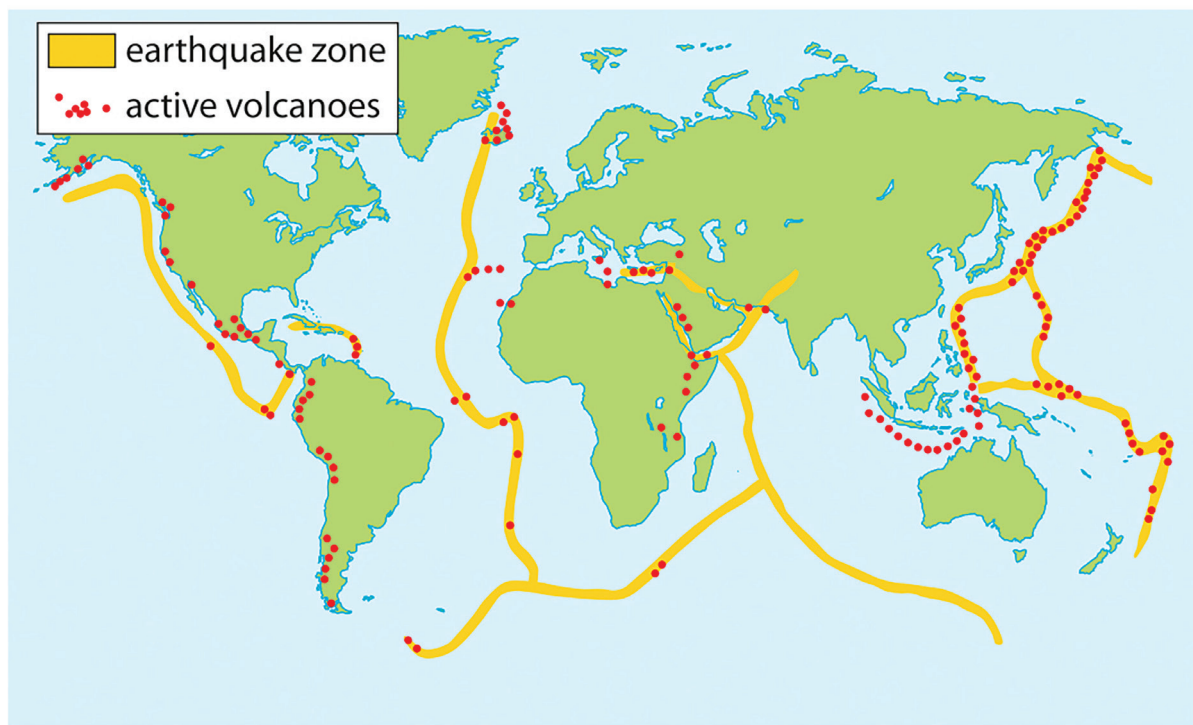
Tectonic plates are constantly moving because the mantle under the plates is very hot. The plates move so slowly we do not notice it. Tectonic plates can be moving away from each other or moving towards each other.



3. Look at the map of Earth's tectonic plates. Which are the seven largest plates? Write them down.

Where do volcanoes and earthquakes happen?

This map shows where earthquakes have happened and where volcanoes are active on Earth.



4. What do you notice about tectonic plates and where volcanoes and earthquakes happen? Write down your ideas.

Lesson 2

How are mountains and volcanoes formed?



Quiz

1. Read the statement below. Tick 'True' or 'False'.
The Earth is made up of four layers. True ☐ False ☐
2. Which of these are the two different types of crust? Tick the two correct answers.
 - a. oceanic crust ☐
 - b. tectonic crust ☐
 - c. continental crust ☐
 - d. core crust ☐
3. Using the correct word from the box, fill in the blank to complete the sentence.

continental

mantle

tectonic

The Earth's crust is made up of large pieces called _____ plates.

4. What is the layer at the centre of the Earth called? Write your answer.

5. What is the mantle made of? Tick the correct answer.
 - a. solid rock ☐
 - b. iron and nickel ☐
 - c. granite ☐

Mountain ranges

A mountain range is a series of connected mountains. The tallest mountain on Earth is Mount Everest, which is part of the Himalaya mountain range. Other big mountain ranges include the Andes, the Rocky Mountains and the Alps.



How fold mountains are formed

When two continental plates move towards each other, **fold mountains** are formed. They are so called because the plates crumple and wrinkle into folds, just as cars do when they collide. The Himalayas are an example of a fold mountain region. The Himalayas formed as the Indian plate and the Eurasian plate collided. These plates are still moving towards each other, so the Himalayas are still getting taller.





1. How were the Himalayas formed? Write your answer.

Volcanoes

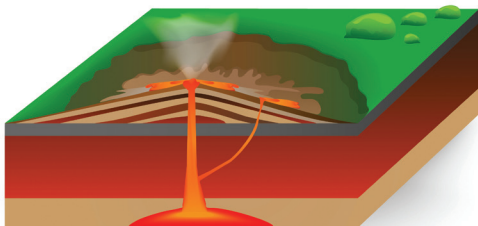
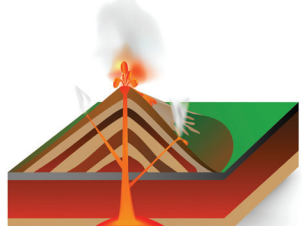
A volcano is a point where **magma**, or molten rock, from an underground magma chamber comes up to the Earth's surface through a vent. It can be relatively flat or mountain-shaped. Magma comes out when the volcano erupts. Once the magma comes out of the volcano, it is called **lava**. Lava, ash and gasses all come out of a volcano during an eruption.



2. What comes out of a volcano when it erupts?

Types of volcanoes

There are two types of volcanoes: shield volcanoes and stratovolcanoes. The table describes some of the differences between shield volcanoes and stratovolcanoes.

	Shield volcanoes	Stratovolcanoes
Diagram		
Formation	Lava flows easily, so a broad volcanic mountain builds up after repeated eruptions	Lava does not flow far, so layers of hardened lava build up a steep volcano after repeated eruptions
Height	Low with shallow sides	High with steep sides
Eruption	Thin, liquid lava is erupted	Thick, sticky lava and explosive debris are erupted
Example	Kilauea (Hawaii) and Erta Ale (Ethiopia)	Mount Vesuvius (Italy) and Barðarbunga (Iceland)



3. Draw lines to link each volcano to its name.



stratovolcano



shield volcano

Where are stratovolcanoes found?

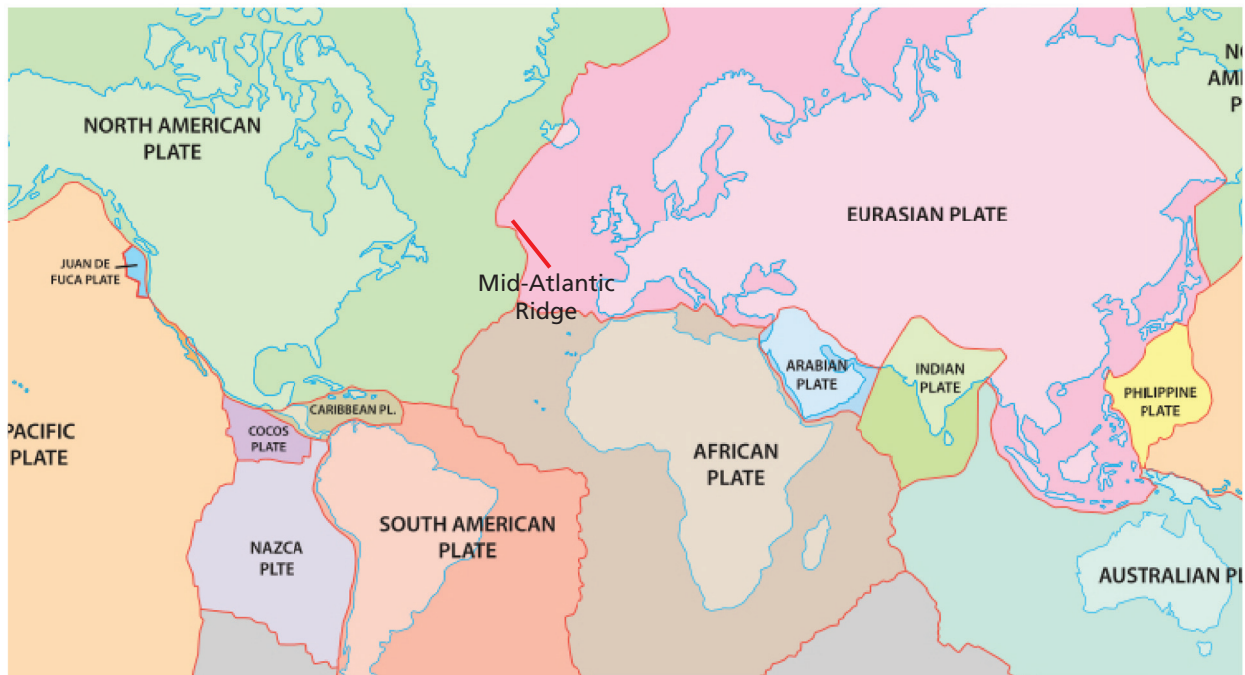
Stratovolcanoes are usually found where oceanic crust is sinking beneath continental crust where two plates meet. Stratovolcanoes are found in chains along the edge of the continental crust. An example of this is the Pacific Ring of Fire.

The Ring of Fire contains 75% of the world's volcanoes. They are located at the points where different tectonic plates collide with the Pacific plate.



Where are shield volcanoes found?

Shield volcanoes are usually found where two tectonic plates are moving away from one another. An example of this is the Mid-Atlantic Ridge, where the North American plate and the Eurasian plate are moving away from each other.



4. Describe what is happening to tectonic plates where shield volcanoes are usually found. Write your answer.

5. Describe what is happening to tectonic plates where stratovolcanoes are usually found. Write your answer.

Lesson 3

How do earthquakes and volcanic eruptions happen?



Quiz

1. Using the correct word in the box, fill in the blank to complete the sentence.

erupt

collide

separate

Fold mountains are formed when tectonic plates _____.

2. Read the statement below. Tick 'True' or 'False'.

The mountains in the Himalayas are still growing taller.

True ☐

False ☐

3. What is a volcano? Write your answer.

4. What is magma called once it erupts out of a volcano? Tick the correct answer.

a. ash ☐

b. mantle ☐

c. lava ☐

5. Fill in the blanks to complete the sentences about the different types of volcanoes.

_____ are short with shallow sides.

_____ are tall with steep sides.

What is an earthquake?

When the ground shakes, this is called an earthquake. The size of an earthquake is measured using the **moment magnitude scale**. The scale goes from 1 to 10, with 1 being the weakest and 10 being the strongest. We don't notice the very weakest ones, but earthquakes that measure over 5 can cause a lot of damage.

Large earthquakes can also cause tsunamis. A tsunami is a series of huge, fast waves that are caused by earthquakes, volcanic eruptions or landslides.

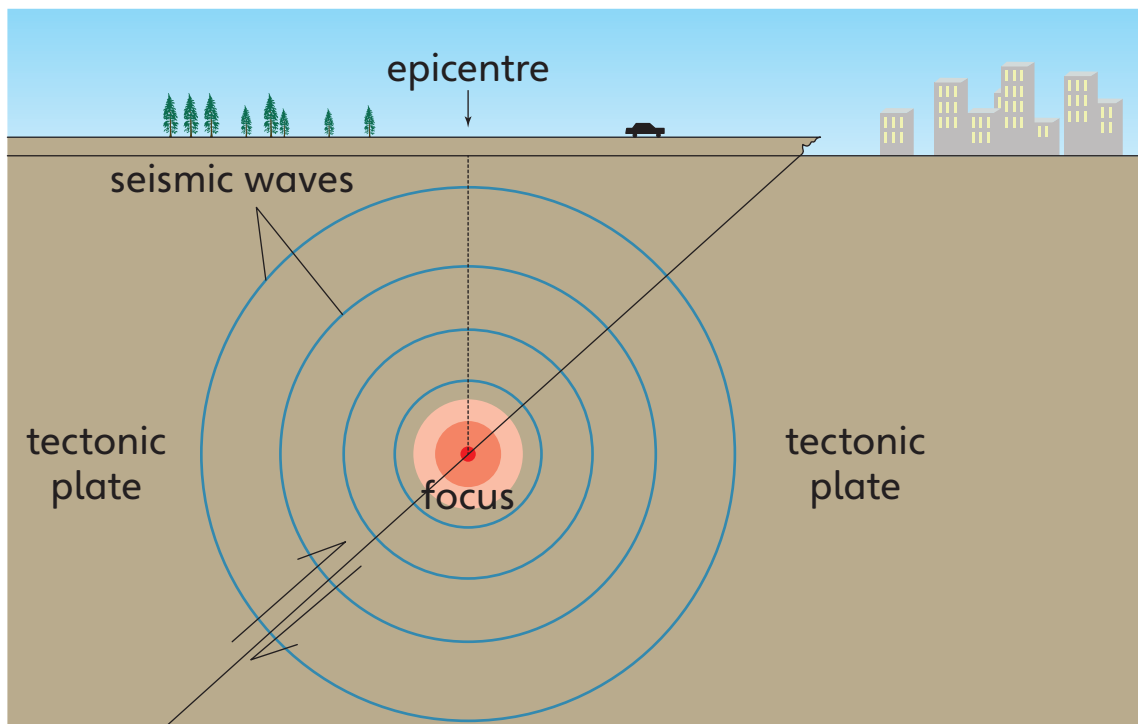


- I. What scale do we use to measure the size of earthquakes? Write your answer.

What causes earthquakes?

Tectonic plates moving past each other creates **friction**, which is a force that slows them down and resists movement.

When plates get stuck, they keep on pushing against each other. Energy builds up until the plates suddenly move past each other, and this causes an earthquake. The point where an earthquake starts, deep in the Earth's crust, is called the **focus** of the earthquake. The point on the surface directly above the focus is called the **epicentre**. Waves of energy called **seismic waves** spread out from the epicentre. These cause the ground to shake.

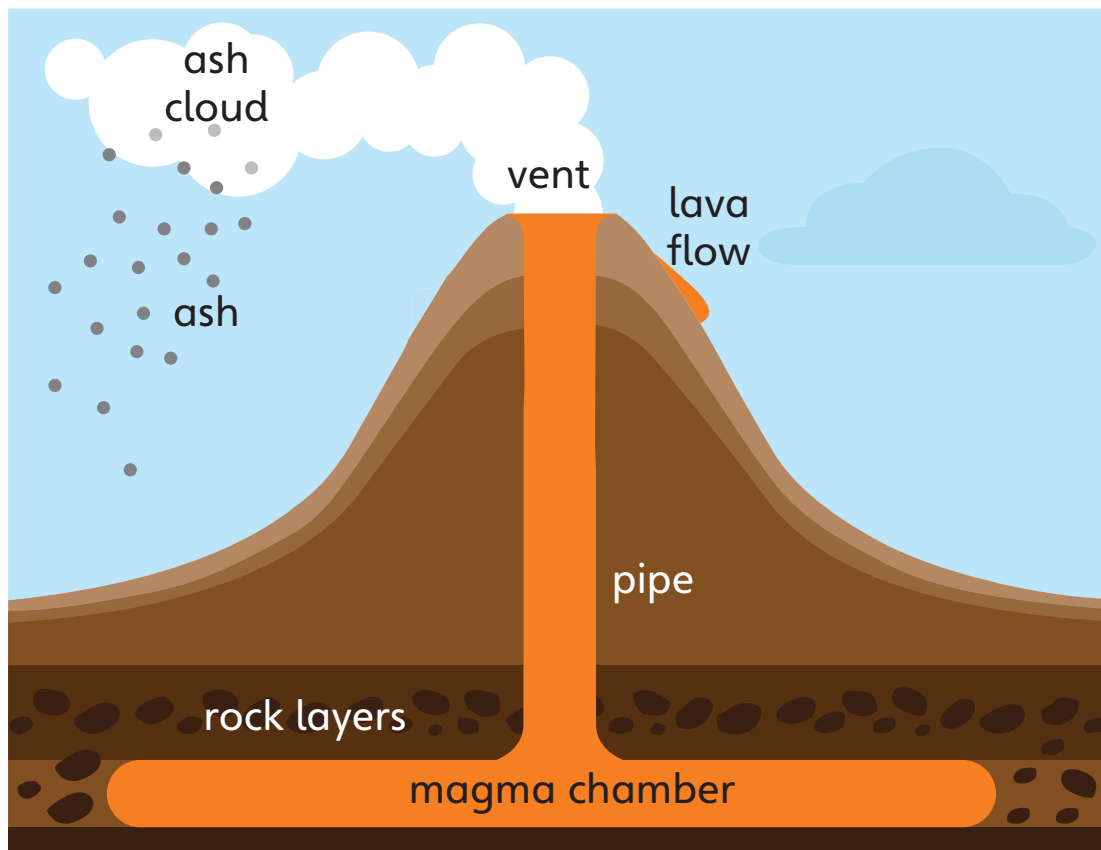


2. How do earthquakes happen? Tick the correct answer.

- a. Two plates move towards each other. ☐
- b. Two plates get stuck then suddenly move past each other. ☐
- c. Two plates move away from each other. ☐
- d. One plate breaks in two. ☐

Volcanic eruptions

Volcanoes erupt when magma rises to the Earth's surface through vents, or gaps, in the crust. Magma is made when the Earth's mantle melts, due to the movement of tectonic plates. As magma collects in a magma chamber, **pressure** in the chamber builds up. Eventually, this pressure forces the magma to burst up through the Earth's crust and erupt as lava.



3. Put these sentences into the correct order. Write a number in each box.

The volcano erupts.

Magma forms and collects in a magma chamber.

The pressure forces the magma to rise up through the crust.

The chamber fills up with magma and the pressure increases.



4. Look again at the map of Earth's tectonic plates on page 7. Why don't we have volcanoes or large earthquakes in the UK?

Can we predict earthquakes?

Earthquakes happen often because tectonic plates are moving past each other all the time. About 50,000 earthquakes happen every year, but many of these are so small that people do not notice.

Large earthquakes can be very dangerous, but scientists do not yet have a way of predicting when an earthquake will happen or how large it will be. Some countries have early warning systems, but these can only warn people a few minutes before an earthquake hits. An early warning system gives people a chance to get to a safe spot, slow down a vehicle if they are driving, or turn off large machinery.



5. Complete the sentences. Write your answers.

Earthquakes happen frequently because _____

Earthquakes happen frequently but _____

Earthquakes happen frequently so _____

Can we predict volcanic eruptions?

It is sometimes possible to predict volcanic eruptions, although it is not always easy. Frequent earthquakes near a volcano might mean the volcano will erupt soon. Scientists can record earthquake activity and look for signs of likely eruptions. Scientists can also study the gas that comes out of volcanoes: if more gas starts to come out, this might be a sign of a volcano eruption. Lastly, scientists can monitor the shape of volcanoes. As magma builds up inside magma chambers, this can cause bulging on the Earth's surface. These signs usually happen days or weeks before an eruption.



6. What three things can scientists study to predict a volcanic eruption? Write them down.

a. _____

b. _____

c. _____

Unit progress check in

1. What are the four layers of the Earth? Write them down.

a. _____

c. _____

b. _____

d. _____

2. Fill in the blank to complete the sentence.

magma chamber

vent

mantle

The part of a volcano where magma collects is called a _____.

3. Read the statements below. Tick 'True' or 'False' for each one.

Earthquakes can be predicted easily.

True ☐ False ☐

Earthquakes can cause tsunamis.

True ☐ False ☐

Volcanoes can only be predicted with a few minutes' warning.

True ☐ False ☐

75% of the world's volcanoes are found in the Ring of Fire.

True ☐ False ☐

4. How do earthquakes happen? Write your answer.

5. What is one way in which scientists can predict a volcanic eruption? Write your answer.

6. Cross out the incorrect words to complete this sentence.

When two plates collide, **fold** / **wrinkle** / **shield** mountains are formed.

Lesson 4

What are the effects of earthquakes and volcanic eruptions?

Quiz

- How do we measure earthquakes? Tick the correct answer.
 - magma moment scale ☐
 - moment magnitude scale ☐
 - mantle movement scale ☐
 - mass movement scale ☐
- Cross out the incorrect words to complete the sentence.
Earthquakes can cause **lava** / **tsunamis** / **fold mountains** / **magma chambers**.
- Using the words in the box, fill in the blanks to complete the sentences.

earthquake friction moving plates

Tectonic plates _____ past each other create a force called _____, which can cause them to get stuck. Energy builds up until the _____ suddenly move, causing an _____.

- Read the statements below. Tick 'True' or 'False' for each one.
Magma is made when the Earth's mantle melts. True ☐ False ☐
We can easily predict earthquakes and volcanic eruptions. True ☐ False ☐
- What can cause a volcano to change shape? Write your answer.

Case study: The Tohoku earthquake

Location: Japan, Asia

Date: 11 March 2011

Size: 9 on the moment magnitude scale

Immediate effects:

- Thousands of people killed or injured
- Thousands of people missing
- Buildings and farmland destroyed

Secondary effects:

- Triggered a huge tsunami
- Tsunami flooded the area and caused damage as far as 10 km inland
- Major disruption to roads and transport links
- Nuclear power station damaged

Immediate response:

- Military aircraft used to find the areas in greatest need of help
- Roads cleared to bring in water, food, medical items and tents for those affected

Long-term response:

- Rebuild roads, railways, power supplies
- Training and education about earthquakes
- Regular safety drills (safety practice sessions)



The Tohoku earthquake was the most powerful earthquake ever recorded in Japan




The earthquake caused a huge tsunami, which flooded the affected area

Effects of earthquakes

Earthquakes can have many different effects. The damage they cause can impact people, money and the environment. We call these the social, economic and environmental effects, and they can all be linked.

For example, if a farmer has their land ruined by a tsunami, they might not have anywhere to live (social effect). If the land is ruined, crops might not be able to grow there in the future (environmental effect). If the farmer cannot grow crops any more, they won't earn any money (economic effect).

-  1. Look back at the Tohoku earthquake case study. Write the immediate effects and secondary effects in the correct boxes in the table.

Social	Effects that have an impact on people
Economic	Effects that have an impact on money
Environmental	Effects that have an impact on the environment

Case study: The Fuego eruption

Location: Guatemala, South America

Date: 3 June 2018

Explosivity level: 3 (moderate)

Immediate effects:

- Hundreds of people killed or injured
- Hundreds of people missing
- Buildings and structures destroyed



The Fuego volcano eruption produced huge clouds of ash and gas

Secondary effects:

- Heavy rain caused landslides
- Crops destroyed so food supplies became limited
- Major disruption to roads and transport links

Immediate response:

- Search and rescue teams sent out to rescue people
- Roads cleared to bring in water, food, medical items and tents for those affected
- People in the area evacuated (taken to a safe place)

Long-term response:

- Rebuild roads, railways, power supplies
- New and improved emergency response systems
- Regular evacuation drills (practice sessions)



Boiling lava, ash and gas flowed down the side of the volcano, destroying everything in its path



2. Why is it a good idea to have evacuation drills, or practise evacuating people to a safe place? Write your answer.

Effects of volcanic eruptions

A volcanic eruption can have similar impacts to an earthquake. People can be hurt or killed, and if their local area is destroyed it can cause problems relating to money and the environment. It can cost a country many millions of pounds to recover fully and fix the damage caused by a volcanic eruption.



3. Look back at the Fuego eruption case study. Write the immediate effects and secondary effects in the correct boxes in the table.

Social	Effects that have an impact on people
Economic	Effects that have an impact on money
Environmental	Effects that have an impact on the environment

Lesson 5

Do the benefits of living near a volcano outweigh the risks?



Quiz

1. What did the Tohoku earthquake measure on the moment magnitude scale? Tick the correct answer.
 - a. 6 ☐
 - b. 3 ☐
 - c. 9 ☐
2. What happened after the Tohoku earthquake struck? Tick the correct answer.
 - a. A volcano erupted. ☐
 - b. A tsunami flooded the area. ☐
 - c. A fold mountain was formed. ☐
3. What word do we use to describe something that has an effect on people? Write your answer.

4. How do we describe something that has an effect on money? Write your answer.

5. When did the Fuego volcano erupt? Tick the correct answer.
 - a. 2011 ☐
 - b. 2016 ☐
 - c. 2018 ☐

Why do people live near volcanoes?

Some active volcanoes erupt so rarely that they are very unlikely to affect people living nearby. But because it is so hard to predict eruptions, it is always a risk to live near a volcano. However, living close to volcanoes can also have a lot of advantages. Volcanoes can be good for farming, energy and tourism.

Farming

Volcanic rock contains a lot of minerals. Minerals are good for the soil, which means lots of different crops can be grown.

The height of a volcano can increase the rainfall in the local area. This rain is also good for crops.



1. Why is volcanic rock good for farmland? Write your answer.

Energy

The Earth's core is very hot. In areas near tectonic plate boundaries, and therefore near many volcanoes, the heat often reaches the Earth's surface. We can use this heat to make electricity and heat water supplies. This is called geothermal energy.



2. What can we use heat from the Earth for? Write your answer.

Tourism

Volcanic regions are popular with tourists, who come to see bubbling mud pools, hot springs and geysers (hot springs that occasionally shoot columns of hot water and steam into the air).

Tourism is good for local people. Tourists spend money in shops, hotels and restaurants, which provides plenty of jobs for people living in the region.



A geyser in Iceland.



Tourists floating in the Dead Sea.



3. Complete the sentences. Write your answers.

It is dangerous to live near a volcano because _____

It is dangerous to live near a volcano but _____

It is dangerous to live near a volcano so _____

Lesson 6

Unit check out



Write an answer to this question: Imagine you are in charge of a town. How would you plan for a volcanic eruption?

Key words

bulging

immediate

predict

drill

lava

protect

evacuate

magma

secondary

gasses

Title: Imagine you are in charge of a town. How would you plan for a volcanic eruption?

Introduction

- What are tectonic plates and how do they move?
- Where are volcanoes found?

Paragraph 1

- How does a volcano erupt?
- What comes out of a volcano when it erupts?

<p>Paragraph 2</p> <ul style="list-style-type: none"> • What are the immediate effects of a volcanic eruption? • What are the secondary effects of a volcanic eruption? 	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Paragraph 3</p> <ul style="list-style-type: none"> • How might you predict a volcanic eruption? • What would you need to do to protect and help people after an eruption? • How would you make sure people knew what to do after an eruption? 	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>Extension</p> <ul style="list-style-type: none"> • Discuss whether you would be prepared to live near a volcano. 	<hr/> <hr/> <hr/>
<p>Conclusion</p> <ul style="list-style-type: none"> • What are the best ways to prepare for an eruption? • Why is it a good idea for people in the town to prepare for an eruption? 	<hr/> <hr/> <hr/> <hr/>

Mountains, volcanoes and earthquakes

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Mountains, volcanoes and earthquakes

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