Zig Zag Education

Geography AS / A Level | OCR | H081/H481

AS and A Level OCR Revision Booklet

Topic 3.5: Hazardous Earth

zigzageducation.co.uk

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Contents

Teacher's Introduction

The revision booklets in this series are designed to support your students as they study AS OCR Geography (H081) and A Level OCR Geography (H481). These revision summaries match the OCR specification perfectly. **This particular set supports Topic 3.5: Hazardous Earth, examined in Paper 3.**

Remember!
Always check the exam board website for new information, including changes to the specification and sample assessment material.

The concept is that *all* students need a clearly explained, concise yet comprehensive body of notes to revise from, both as they progress through the course and when preparing for the end-of-course examination. For this reason, the booklets are broken into manageable chunks and are provided in both A4 and A5 formats for easy photocopying. A5 booklets allow easy carrying and reference for students, right up to the moment they walk into the exam hall, and allow for effective revision time.

Since revision should be ongoing throughout one's study, it is recommended that after teaching each topic you issue students with the relevant revision booklet as they progress through the course. The booklets can also be issued as a complete revision pack in the run-up to the examinations.

By use of bullet points, text boxes and grids, these revision booklets provide succinct yet comprehensive and relatively detailed coverage of the specification content – probably far more than one would expect from a revision summary.

Each topic follows a clear structure of:

- **Key words:** lots of key words are clearly defined, and by covering up the definitions with a sheet of paper, students can easily self-test their memory of these all-important terms.
- **Key points:** these form the main body of the summaries for each topic. Concise, detailed and easy to follow, they provide a solid bank of notes to support students' knowledge, understanding and evaluation.
- **Core content:** the main content of the specification in bullet points, boxes and diagrams. Boxes with suggested examples allow students to name-drop examples in their exam, or give ideas for further research.
- **If you only remember these three things…:** the three most important takeaways from the topic.
- **Consolidation questions:** several quick questions on the core content – designed to ensure that the key points have been retained.
- **Take it further:** offers suggestions to support the option of extending learning further.
- **Student checks:** useful checklist to help students monitor their own learning.

Each pack also contains a **students' introduction** which introduces the topic and sets out some of the exam structure; introduces command words, AOs and level marking, along with exam tips and a checklist; and explains how to use the booklet. At the end tips are included on time management, and planning and writing answers, along with an introduction to synopticity.

By using this resource, teachers will know that all students have the key points for all the topics of the course in a clear, written format. It saves time in class for teachers and decreases the amount of preparatory work needed outside class.

This resource also helps achieve greater equality among students of differing abilities, as often the weakest students make the least helpful notes from which to study and revise outside class. These easy-to-understand revision summary notes help to overcome this problem and promote greater equality of opportunity.

And remember, these revision booklets are also perfect to refer back to as end-of-year summaries before the examination – especially useful nowadays with linear examinations.

I trust that you and your students will enjoy using these revision summaries as much as I have enjoyed writing them for you.

October 2019

Students' Introduc

What's the topic?

If you're reading this, your teacher has chosen to tea[illegible]u the optional mo
Nothing on Earth is static – not even the grou[illegible] your feet. The tecto
volcanoes and earthquakes. Millions o[illegible]le around the world are expose
adapted to them the best we c[illegible].

You will be [illegible]this topic in Paper 3. You will answer questions on
but you wi[illegible]se ONE of the 33-mark hazard questions on in section C.

Here's a quick overview of the things you might find in the exam. However,
sometimes exam boards can throw in a curve ball – a different type of quest
structure – but don't be too alarmed. Just read the questions carefully and b

You'll be presented with a range of questions – remember that they ramp u

- Firstly, you might be presented with a short factual recall question.
- Then you might be given a couple of figures – maps, charts and data. Yo
  these before. They're designed to see how you cope with unfamiliar so
  interpret and analyse them.
  - You may be asked to use the figure(s) and your knowledge to answ
  - These might be medium-length questions.
- Finally, you'll get a longer, essay-based question. You'll probably be
  asked for your viewpoints or to weigh up two si[illegible]f an argument.
  You may also be able to use a case study to s[illegible]ort your answer.
  Justify your opinion(s), and sup[illegible]th facts and balanced
  arguments if you are re[illegible]the higher marks. You'll need to
  draw on your kno[illegible]nd offer a supported opinion. PEE or,
  even b[illegible]here! And no, we don't recommend you get out a sat
  togeth[illegible]lence.

If you're studying this at **AS**, the exam questions are in Paper 2.

How to use this guide

You may be given this at the start or at the end of teaching on the topic. Don't w
being stuffed in your pocket (although don't take it into the exam itself!). Remen
you want to. Scribble all over it, or highlight bits you need to look at again.

Here are some brief suggestions:

- Work through it as you go through the course.
- Give it a glance after the lessons.
- Give it a read before an upcoming test.
- Use it when you revise, of course – [illegible]s even outside the exam hall if yo

Now write down the dat[illegible]exam. You can use this to plan your revision tim

Date of m[illegible]n:	

Checklist

It can be a useful idea to make a note of when you've read through something. I confident that you know a topic, or you last looked at this six months ago, then i another *look*!

Topic	When did I [illegible] this? *Write the da[illegible] preferably today's*	I kn
Plates, Movement, Earth's Structure and Plate Boundari[illegible]		
Volcanoes – Cause[illegible] and [illegible]ion [illegible]azards		
Earthqual[illegible] Causes, Features and Hazards		
Why Do People Live in Hazardous Areas?		
Protecting Ourselves from Hazards		
Case studies: Volcanic eruptions and earthquakes		

Exam tips

Now that you've thoroughly revised and hopefully answered a few sample exam good idea of what to expect in your exam.

Remember that the Section B questions are [illegible]. You will need to link to co course within your answers.

Command words

In each que[illegible]here are 'command words'. These are essentially the instructio to answer th[illegible]estion, and give you a clue on the type of response the examin

Command words are not a secret, and they're nothing to worry about. You've pr throughout your year(s) studying the course.

Here's our quick run-down of the different command words and what you need balanced answer.

- ✓ **DESCRIBE:** Identify the main ideas, processes, or a source. But you don't ne
- ✓ **SUGGEST:** Use a diagram or your knowledge to identify a cause or reason.
- ✓ **IDENTIFY:** Using data or knowledge, pick out issues, e.g. find limitations wi an indicator.
- ✓ **ASSESS:** Show knowledge of a topic and give evidence on both sides of an
- ✓ **EXAMINE:** Present facts and explain them. Show[illegible]ce and balance.
- ✓ **CALCULATE:** Perform a calculation such as [illegible]stical test.
- ✓ **EXPLAIN:** Set out causes of the i[illegible]e, [illegible]t and/or factors influencing its fo understanding of proces[illegible]
- ✓ **OUTLINE:** Provide [illegible]f account of relevant information.
- ✓ **DISCU[illegible]** o[illegible]for and against of an argument, and come to a conclusio betwee[illegible]s.
- ✓ **HOW FAR / TO WHAT / ASSESS THE EXTENT:** Express opinion on merit or examining evidence and/or different sides of argument.

Assessment objectives

You may come across the words 'assessment objectives', or 'AOs' for short. These command words. They are set by the government and vary by subject. As you'd get, and AO3s are the hardest.

Here's a quick summary:

	What you need to do	R
AO1	Show your knowledge and understanding of geographical concepts and issues	✓ Collecting evi together
AO2	Manipulate and draw conclusions from geographical information, both familiar and new	✓ Use of maps, ✓ ICT skills: usin ✓ Analysis, pres
AO3	Investigating questions and reaching conclusions through many geographical skills and techniques	✓ Concluding a ✓ Use of maps, ✓ Statistics ✓ ICT skills: usin ✓ Analysis, pres

In your Paper 3 exam, you'll mostly be assessed on AO1 and AO2. There will be v most of those in the NEA (fieldwork investigation).

For every question, OCR will have decided which AOs they are targeting. Bear th answer. If it's clear that an answer is looking for some AO2 or AO3 marks, don't s through.

You might find it useful to have a look at a couple of mark schemes for the topic each AO marks are achievable.

Level marking

Now that you've got a handle on how the command words work and what the e you need to know is how they will mark your answers.

For anything but the shortest of questions, you will be level marked. Each level h L1 = 1–3 marks, L2 = 4–6 marks. The essay-based questions will have four levels. for, the more marks you'll get.

An example of level marking criteria can be found below (for a 33-mark question and AO2).

AO1 (9 marks)

Level	Mark	Descriptor
Level 1	(1–2 marks)	• The student shows only basic comprehension and insu details may be incorrect and not in line with the contex
Level 2	(3–4 marks)	• The student shows basic comprehension and some factual re and generally in line with the context of the question.
Level 3	(5–6 marks)	• The student shows good comprehension and factual re and tailored to the context of the question.
Level 4	(7–9 marks)	• The student shows excellent comprehension and factu

AO2 (24 marks)

Level	Mark	Descriptor
Level 1	(1–6 marks)	• The student addresses a narrow range of ideas, and de inferences and links made. • Insufficient explanation is present. • Ideas are poorly supported, and may be one-sided. Discus • No judgement and/or concluding remarks.
Level 2	(7–12 marks)	• The student addresses a range of ideas, to a reasonable • Some explanation is present. • Ideas are supported, but may be one-sided. Discussion • Some judgement and/or concluding remarks.
Level 3	(13–18 marks)	• The student addresses a wide range of detailed ideas, w and links made. • Good explanation is present. • Ideas are often supported, with both sides supported.
Level 4	(19–24 marks)	• The student addresses a wide range of detailed ideas, w articulated inferences, and many links are made. • Clear explanation is present. • Ideas are well supported, with both sides supported. D

Plates, Movement, E
Structure and Plate Bou

Key words

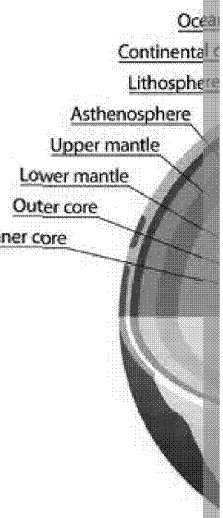
- ✓ **Lithosphere:** The section of Earth's m... w... includes the crust and upper
- ✓ **Asthenosphere:** The upperm... t... f the mantle roughly 80–200 km bene... surface. This is the l... w... rectonic plates rest and move.
- ✓ **Plate tec...nic... ...:** Theory that the crust is divided up into smaller section... mant... a... ...ove.
- ✓ **Sea-fl... ...preading:** Process by which oceanic plates split apart and new cr... of basaltic magma.
- ✓ **Convection currents:** Material in the mantle rises up and down. Hot material, upwards. As it cools, density increases and it sinks once again.
- ✓ **Gravitational sliding:** Secondary form of plate movement, caused by the he... crust at ocean trenches.
- ✓ **Slab pull:** Process by which dense and old oceanic crust is pulled down under subduction zones.
- ✓ **Convergent boundary:** Land is destroyed as two plates collide. The denser (... (subducted) below the lighter plate and melted in the mantle.
- ✓ **Divergent boundary:** Two plates pull apart creating new land – ocean ridge
- ✓ **Conservative boundary:** Plates move past each other, but no land is destroy... suddenly released, often as powerful earthquakes.
- ✓ **Magma plume:** Upward flow of hotter magma than the surrounding mantle.
- ✓ **(Young) fold mountains:** Mountains made of thick accu...ulations of sediment... edges of continents where two plates collide, e.g. th... Himalayas.
- ✓ **Rift valley:** Narrow depression between an up...d area on each side, somet... boundaries, as the two plates pull ap...
- ✓ **Ocean ridge:** Area of ra...e se...ed, where two tectonic plates are spread ... boundary.
- ✓ **Deep... ...er:** ...ep depression found along the seaward edge of conver...
- ✓ **Islan...** ...Often crescent-shaped line of volcanoes protruding from the ocea... boun...y.

Key points

- The main layers of Earth are the crust, mantle and core (inner and outer core)
- The crust is divided into two types – continental and oceanic. The oceanic crus... younger and denser than the continental crust.
- Earth is hot because of residual heat from its creation, and radioactive decay...
- The crust is broken up into plates which move. We know this due to magnetic... there's lots of rock and fossil evidence.
- New crust is formed at divergent boundaries, and old crust is destroyed at co... Crust is neither created nor destroyed at conservative boundaries.
- Plates move due to a combination of convect...ents, gravitational sliding... slab pull at convergent boundaries.
- The type of boundary contr...s... of features that you'll find. You'll al... boundaries, but you... ...volcanoes at conservative boundaries. Someti... seismic a...ivit... ...om plate boundaries.

Earth's Structure

Earth is divided into layers:



1. **Crust** – oceanic (below the oceans) and continental (below the land).

   Continental crust (older) – lower density, thick – average 35–40 km thick, high mountains 70 km.

   Oceanic crust (younger) – higher density, thinner – average 7-10 km thick.

   The lithosphere = crust + highest mantle.

   Asthenosphere = upper mantle.

2. **Mantle** – largest part – hot! Mostly solid or plastic-like, with superheated °C near the core.

3. The **core**.
   a. Outer core – very hot – liquid iron and nickel – at 2,700 to over
   b. Inner core – incredibly hot – solid nickel and iron – maybe 6,0

Earth gets its heat from two sources.

- **Primordial** heat (left over from when Earth was formed)
- **Radioactive decay** of elements.

Why Plates Move

There are three main theories for plate movement. Plates move because of a com

1. **Convection currents** – plumes of hotter material in the mantle rise to the s crust, spread out, and sink, exerting pressure on the plates, forcing them ap

2. **Gravitational sliding (ridge push)** – material built up at ocean ridges is pushed downwards under gravity.

3. **Slab pull** – at convergent boundaries, the oceanic plates are subducted, an

! The Cocos and Nazca plates move the fastest because they're

NB You may also see 'boundaries' referred to elsewhere as

Continental Drift and Evidence

All of the continents were once lumped together as a supercontinent called Pan separated. This was hypothesised by Alfred Wegener in 1912, but the theory wa time. He couldn't explain how the continents moved.

Evidence for the movement included:

- The way they looked like they fitted together.
- Geological evidence – rocks, mountains, glacial moraine and other deposits
- Fossil evidence.

It turned out that the crust is divided into **tectonic plates** – the plates are shown on the map below.

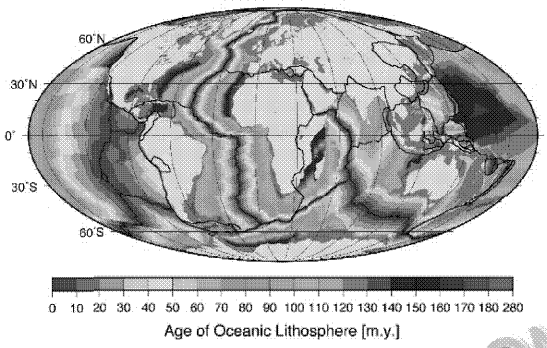
What is ma

When lava cools, iron cr

The polarity reverses – it mill

So we can measure the there are matching stripe

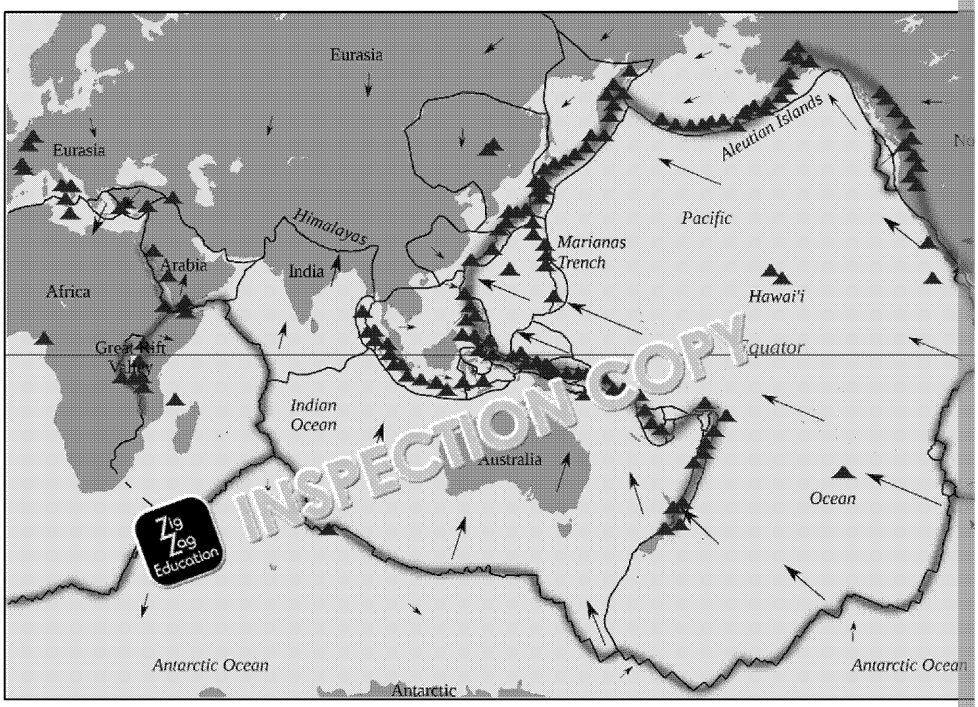
The evidence: **sea floor spreading** at the Mid-Atlantic Ridge – detected by magnetic striping. The plates move apart and magma wells up to fill the gap, forming tall ridges of pillow lava.



The age of rocks can also be estim older than the oceanic crust – pro destruction of crust at convergent youngest at the divergent bound floor spreading.

The Tectonic Plates

- Earth's crust is divided into oceanic and continental plates. There are aroun several smaller ones. The arrows on the map below show the directio Longer arrows indicate faster movement.



The Types of Plate Boundary

Boundaries are the edges of the plates. There are three main types, classified bas
they move.

Divergent

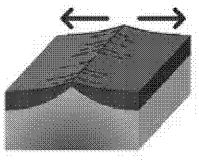
- Two plates move apart.
- Usually oceanic plates.
- Forms new land.
- Rift valleys on l

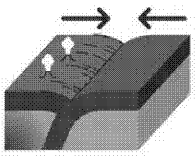
E.g. tlantic Ridge

Convergent

- Two plates push together.
- Often continental and oceanic plates meet (but can be two oceanic plates).
- The thinner, denser oceanic plate is forced downwards where it melts. This is called **subduction**.

E.g. South America, Pacific Ring of Fire





Collision boundaries

There is another type of boundary called a **collision boundary**. This is where tw
continental plates meet. There's little subduction as no have the same density,
but the material is forced upwards instead e.g. to make the Himalayas!

Features at Plate Boundaries

We can see the boundaries of plates because of:

- Earthq tivity
- Landfor

Here's a rundown of the different types of landform at each type of plate bound

Divergent boundaries

Ocean ridges
Upwelling of magma at divergent boundaries forms a ridge.

E.g. Mid-Atlantic Ridge

Divergent bounda
the surface as the
fall downwards.

E.g. Ea

Convergent boundaries

Island arcs
Volcanoes occur at co g boundaries as the increased mo by the melting crust rises to the s When the volcano reaches above sea, an island is formed.

E.g. Philippine islands, Japan

Dee
Occur at convergent
plat

E.g. M

Fo
Sediment on top of
scrape

E.g. An

Conservative boundaries
Land is neither created nor destroyed at conservative boundaries – there are no
Sometimes the fault lines and the folding of rocks are visible.

E.g. San Andreas Fault, California

Collision boundaries

Young fold mountains
Still form... w... o continental plates meet,
...g the mountains upwards.

E.g. Andes, Alps and Himalayas

- We find volcanoes at divergent and convergent boundaries.
- Earthquakes occur at <u>all</u> types of plate boundary.

Volcanoes
There are two main types:

Shield volcanoes – <u>divergent boundaries</u>. Low volcanoes formed from magm... non-violent (**effusive**) as the lava is runny and gases easily escape and l...

E.g. Mauna Loa

Composite volcanoes – <u>convergent boundari...</u> ...ali... ...lcanoes made of lava ... because the magma is sticky (made fro... ...er ... crust) and trapped steam an...

E.g. ...ount Etna, Mount Pinatubo, Mount Fiji

If you only remember these three th...

1. Earth is divided into different layers, from the crus... divided into a series of tectonic plates.
2. The tectonic plates move through convection curre... slab pull to form several types of plate boundary... directions – some boundaries destroy land, others ... neither create nor destroy land.
3. We get earthquakes at plate boundaries, and vol... number of characteristic features seen at each typ...

Activities

Consolidation questions

1. Which layer of Earth is liquid?

   .....

2. When was the theory of plate tectonics developed?

   .....

   .....

3. Why are the Nazca and Cocos plates moving the fastest?

   .....

   .....

4. Why is Earth not getting any larger if there are divergent boundaries?

   .....

   .....

5. Which feature would you find in East Africa, where the African Plate is splitting (between the Nubian and Somali Plates)?

   .....

Take it further

Take a journey through the Earth's layers. There are a few interesting facts and figures. Watch out for the style change at the bottom of the screen.
zzed.uk/9[illegible]c-earthcentre

Student checks

Topic	What Do I Know?	No Idea ☹	Nearly 😐	Sure ☺	
Plates, Movement, Earth's Structure and Plate Boundaries	Earth's structure				
	Why plates move				
	Continental drift and evidence				
	Tectonic hazards				
	Types of plate boundary				
	Features at plate boundaries				
	Types of volcano				

Volcanoes – Causes, Fea
Eruption Hazard

Key words

- ✓ **Plate boundary:** The boundary bet… w… ctonic plates.
- ✓ **Hotspot:** Site of a volcano … plate boundary as hot magma rises … the crust.
- ✓ **Shield v…** …rm with a central vent and gently sloping sides, built … flows … Loa, Hawaii.
- ✓ **Comp… volcano:** Steep-sided, pyramid-shaped landform built up from a… lava flows, e.g. Mount Vesuvius, Italy.
- ✓ **High-viscosity magma:** Underground material that is very sticky and silica-r… formed from melted crust at convergent boundaries.
- ✓ **Low-viscosity magma:** Underground material that flows relatively freely, w… basaltic), often formed of mantle material, not melted crust.
- ✓ **Effusive eruption:** Low-magnitude volcanic ejection, such as runny basaltic la… vent – little height of ejecta is maintained.
- ✓ **Explosive eruption:** Violent ejection of volcanic material due to a great build… gases and viscous magma often at a convergent plate boundary.
- ✓ **Supervolcano:** Volcano capable of the largest type of eruption – 1,000 km³ (…
- ✓ **Volcanic Explosivity Index (VEI):** Classification of volcanoes based on the v… eruption height and the duration of the eruption.
- ✓ **Pyroclastic flow:** A mixture of volcanic rock, ash and gases, heated to upwa… rapidly downslope, sometimes at 700 kph.
- ✓ **Lahar:** Volcanic mudflow composed of pyroclasti… …al and water which … along a river channel.
- ✓ **Tephra:** Generic name for materi… …d from a volcano; can be subdivide… volcanic bombs, to smaller ash.
- ✓ **Volcanic gases:** S… …d dioxide and carbon dioxide, among others, ejected f…
- ✓ **Jökul… s:** … outburst flood caused by a heating or a volcanic erupt… from … glacial lake.
- ✓ **Tsuna…** …high wave at the shore with potentially devastating consequences. … volcanoes and landslides are triggers.

Key points

- Volcanoes occur at convergent and divergent boundaries as well as at hotsp… conservative boundaries.
- The most dangerous volcanoes occur at convergent boundaries, e.g. the Pacif… lava is very different to that at divergent boundaries – much stickier and exp…
- *Shield volcanoes usually occur at divergent boundaries, while composite volc…* boundaries.
- We can measure the magnitude of an eruption on the V…lcanic Explosivity In…
- Primary effects include ash fall, pyroclastic fl… …, gas emissions, while se… tsunami, and many effects to humans, … …e destroyed or damaged…

Where Do We Find Volcanoes?

- Nearly all volcanoes are found at plate boundaries – 80% at convergent, and 15% at divergent. The other 5% are intraplate.
- The Pacific Ring of Fire can be clearly seen on the map of volcanoes overleaf.

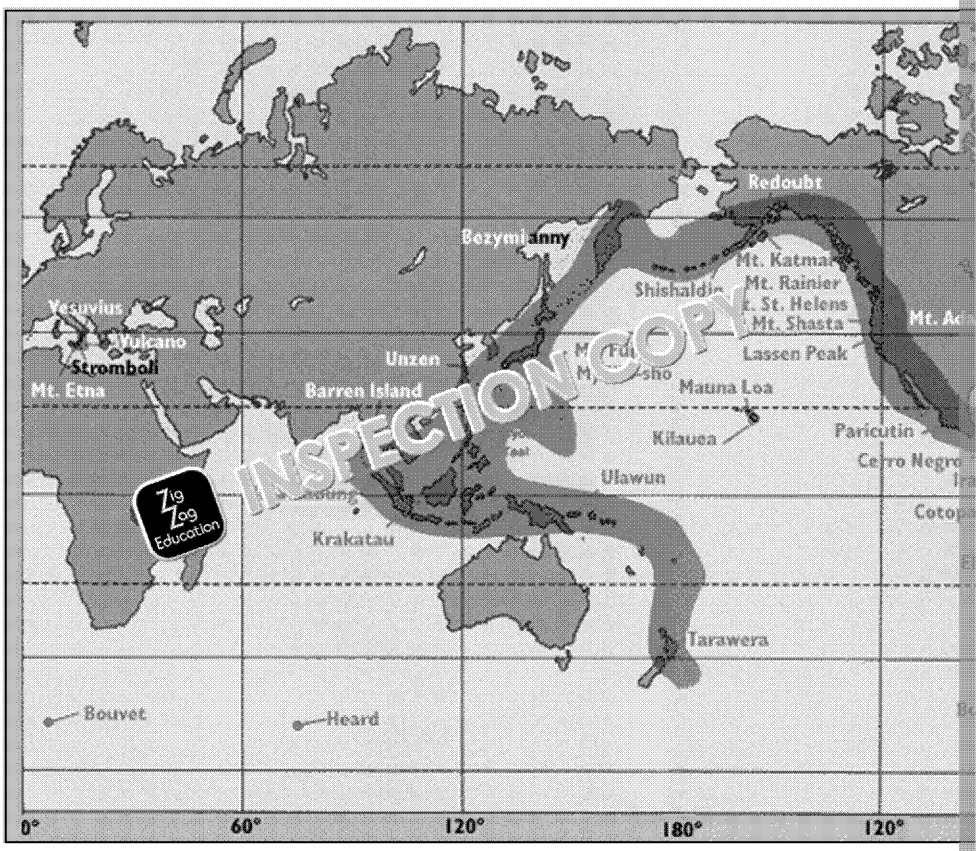
Volcanoes are found in the following locations:

Divergent boundaries
As the sea floor spread[s] magma rises to fill the gap. [Lava] is runny.

Also at rift valleys because the crust thins, allowing magma to work through.

Convergent boundaries
The subducting plate melts, meaning that the increase in magma moves to the surface.

Eruptions are powerful – the magma is very viscous.



NIIHAU

Hotspots and Rift Valleys

E.g.

The Hawaiian Islands are formed by [a] **hot spot**. These are volcanoes in the centre of pla[tes]

The plume p[enetrates] through the crust, forming the island. As the plat[e] move[s] [new] islands are formed, meaning that volcanic activity sto[ps] [on] the older islands.

Where the crust thins in rift valleys, magma can also rise and break through the [crust]

Eruptions, Volcano Size and Shape

There are two main types of volcano. They produce different types of lava, erupt changes their shape.

Shield volcanoes

- Divergent boundaries.
- Low, gently sloping flows of lava.
- Hot, runny 'basaltic' lava, low silica.
- Flows from the mantle.
- Eruptions are **effusive**.
- Can produce large ... cooled lava (lava ...)

Composit

- Convergent boundaries.
- Steep-sided, layers of a
- Cooler, sticky 'andesitic' content.
- Magma from melted cru
- Lava cools and plugs the
- Eruptions are **explosive**.
- Eruptions can mean that th

- The largest volcanoes are capable of being classified as 'supervolcanoes'. Th kilometres of material or more.
- They occur very infrequently – but have the potential for major global disru

E.g. Yellowstone has erupted in the past possibly on the scale of a sup erupt in the same way again.

Measuring the Scale of Eruptions – the Volcanic Exp

We measure volcanic eruptions on a logarithmic scale called the **Volcanic Explo** uses the three following indicators:

- volume of material ejected
- eruption height into the atmosphere
- and the duration of the eruption.

The magnitude is the vo... ...e intensity is the duration (speed).

Primary Hazards

- Primary hazards occur as the volcano is erupting, e.g. lava and pyroclastic fl

Lava flows
Runny lava at divergent boundaries flows down the sides of volcanoes. Burns everything in its path, but usually escapable.
E.g. Hawaii

Pyroclastic flows
Hot gases and ash (up to 1,000 °C) race down the volcano at around 100 kmph, burning everything.
E.g. Mayon Volcano, Philippines

Th
ki

Gases and acid rain
Release of CO_2 ... affects the surrounding villages and a
Sulphur dioxide forms acid rain.
E.g. Lake Nyos, and Mount Nyiragongo

Lava or magma?
Magma is the molten rock below Earth's surface. Lava is the magma th

Secondary Hazards

- Secondary hazards occur after the volcano has erupted. They are often a re
  lahars, famine and other human effects.

Mudflows (lahars)
Ash mixes with rainwater or melted ice caps – resulting in a concrete-like flow of mud.

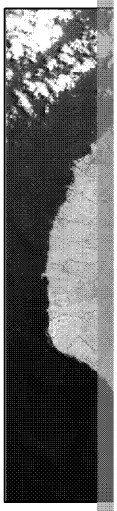
E.g. Mount Mer
Ind

Flooding (Jökulh
Glacial outburst flood
heating or a volca
below ice, releasing
a subglacial l

E.g. Vatnajökul

Tsunam

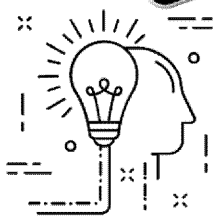
- Tsunami (usually associated with earthquakes) are a secondary hazard. They are caused by volcanic eruptions, especially where large pieces of the volcano collapse or are blasted into the sea by a lateral eruption.



E.g. The eruption of Krakatoa (Indonesia) in 1883 caused a major tsunami.

The photo shows Pico do Fogo in Cape Verde. An eruption caused a tsunami 73,000 years ago.

If you only remember these three th



1. Nearly all volcanoes are found at convergent and
   Volcanoes are also located at hotspots and rift va
2. Volcanoes at convergent boundaries are very pow
   those at divergent boundaries are less dangerous
   eruptions.
3. There are many volcanic hazards – primary hazar
   as well as secondary hazards, which are sometime
   measure the scale of eruptions on the VEI scale.

Activities

Consolidation questions

1. Hawaii is located on a hotspot. Would you expect eruptions to be explosive

.....

.....

2. Would you expect eruptions with in the Pacific Ring of Fire to be explosive o

.....

.....

3. Why are volcanoes located at rift valleys?

.....

.....

4. Are the eruptions of supervolcanoes such as Yellowstone likely?

.....

.....

5. Which is more dangerous, a pyroclastic flow or a lava flow?

.....

.....

6. Give an example of a secondary volcanic hazard.

.....

.....

Take it further

Take a look at this video:
Volcanoes 101 – National Geographic (2:28)
zzed.uk/9989-natgeo-volcano
Note sensitivity warning at 1:59 of skeletons at Pompeii

Take a look at a few seconds from this clip:
zzed.uk/9989-erta-ale
The volcano is located at a rift valley. Can you suggest why the volcano is eruptin

Student checks

Topic	What Do I Know?	No Idea ☹	Nearly 😐	Sure ☺	
Volcanoes – Causes, Features and Hazards	Where do we find volcanoes?				
	Hotspots and rift valleys				
	Eruptions, volcano size and shape				
	Eruption scale – VEI				
	Primary hazards				
	Secondary hazards				
	Tsunami				

Earthquakes – Causes, F and Hazards

Key words

- ✓ **Focus:** The point within Earth's crust fr... wh... a sudden pressure release oc...
- ✓ **Epicentre:** The point on Earth's ... directly above the focus where an earthquake...
- ✓ **Benioff zone:** Part of ... subduction zone where the descending oceanic crus...
  The increased ... friction at this region create a zone of earthquake hy...
- ✓ **Seismic wave:** ... pressure oscillation propagating through the ground, as energy...
- ✓ **Shallow-focus:** Earthquake with focus close to the surface (0–70 km).
- ✓ **Intermediate-focus:** Earthquake with focus depth of 70–300 km.
- ✓ **Deep-focus:** Earthquake with focus depth of between 300 and 700 km.
- ✓ **Magnitude:** The amount of energy, for example, delivered by a seismic even...
- ✓ **Seismometer:** Device used to measure earthquakes – the movement of the gr...
- ✓ **Moment magnitude scale:** Scale of the amount of energy derived from an e... the Richter scale.
- ✓ **Modified Mercalli scale:** A 12-point scale which measures the impact of an e... (detected by instruments but not felt by people) to Level XII (total destruction ... significant modification of natural landscapes).
- ✓ **Rift valley:** Narrow depression between an upland area on each side, somet... boundaries, as the two plates pull apart.
- ✓ **Escarpment:** Differential land height along a fault line caused by horizontal ... high ridge remaining after an adjacent downward fall.
- ✓ **Primary hazard:** Damage and danger caused by the direct shaking of the g...
- ✓ **Secondary hazard:** Damage caused after the e... as a result of the ...
- ✓ **Ground-shaking:** Movement of Earth's surface ... to a seismic event.
- ✓ **Liquefaction:** Saturated or partially ... sediments (such as soil) lose m... earthquake and act like a liquid.
- ✓ **Avalanche:** Rapid ... movement of snow, can be caused by an earthqu...
- ✓ **Landslide:** Down... flow of soil and unconsolidated material, can be triggere...
- ✓ **Tsunami:** ... wave at the shore with potentially devastating consequences. ... volcanoes and landslides are triggers.

Key points

- Earthquakes are the shaking of the ground and mostly occur at plate bound... breaks, causing a shockwave as pressure is released. There are four types of ... The earthquakes located at the different boundaries have different characte...
- Earthquakes can be classified based on depth, and their power can be meas... either based on the energy, or their effects.
- Earthquakes can modify the ground. They result from movement of the plates ... mountain-building and folding of rock. They can cause the ground to rise and ... valleys.
- Primary effects include ground shaking and ... causing damage to bu... environment. Secondary effects include ... landslides and tsunami, ... economic effects.

What are Earthquakes?

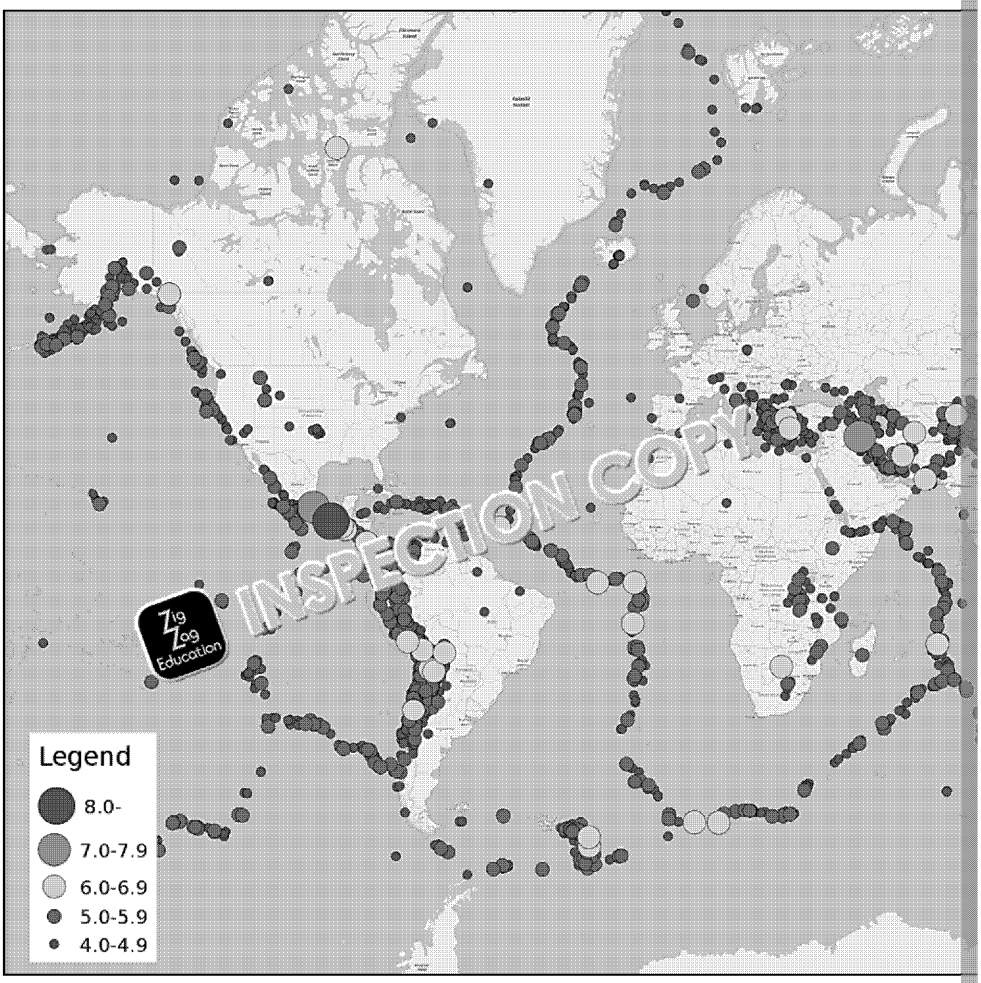
Earthquakes are the shaking of the ground. They are caused by shockwaves as r
releasing built-up stress.

Focus: The area below ground where the rock fractures and the shockwaves are
Epicentre: The ground surface directly above the focus, wh e the most damage

Where and Why Do Earth es Occur?

Most earthquakes occur at pl bou anes.

- They occur at all t r boundary.
- They c ca d by volcanic eruptions.
- They ca r away from boundaries, along old fault lines.



This map shows the larger earthquakes recorded in 2017. The outline of the plat

Divergent
Occur as the plate cracks apart and tension is released, often at c ri

Convergent
Occur at th n. ff zone e oceanic plat subducts. The plates lock together, pressure is released.

Conservative
The plates moving at different directions o speeds lock, and suddenly move.

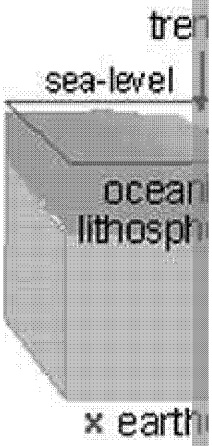
Seismic Waves

Earthquakes have four types of **shockwave**.
The first waves are primary waves (P waves) – compressions and expansions.
Then come the secondary waves (S waves) – they move up and down.
Surface waves (or Love waves) shake from side to side.
Rayleigh waves roll like ocean waves.

Each type of wave travels differently through Earth's crust – some can't travel th

Types of Earthquake

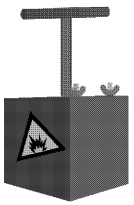
- The depth of the focus can help determine how much energy reaches the s
magni Most of the world's earthquakes are shallow-focus. Powerful sh
cause a damage because the shockwaves travel through less rock – sc
- Earthquakes are said to be 'deep-focus', 'intermediate-focus', and 'shallow-f
- Earthquakes associated with divergent boundaries tend to be shallow-focus
- Conservative margins can produce powerful, shallow-focus earthquakes as the locked plates suddenly move, releasing the built-up tension.
- At convergent margins, one plate is subducted. The two plates can be continental and oceanic, or both oceanic. This wide area where the two plates collide is called the **subduction zone**. We call the area which produces the earthquake foci the **Benioff zone**.
- Convergent margins tend to lead to earthquakes at all depths, but they can produce intermediate-focus and deep-focus earthquakes.
- Convergent margin earthquakes can be very powerful because of the great tension that can build up
- At collision margins there is little subduction, so earthquakes are fairly shallow.



Measuring the Scale of Earthquakes

We can class earthquakes based on:

- The energy released.
- The physical effects.



The energy
E.g. the **Richter** and **moment magnitude scales.**
They are logarithmic.
They are measured using seismometers.
! Nowadays we usually use the moment magnitude scale!

Th
E.g. the **mo**
We use measure
earthquake was fe

Impacts on the Landscape

- Features created through tectonic movement (which are associated with earthquakes) are found throughout the world – such as the folding of rocks and the building of fold mountains.
- The results of earthquakes can be seen in some areas of the world – as plates pull apart and areas are raised and lowered.
- An example is rift valleys, where **escarpments** (s[illegible]lts) are formed, shown by the slumping blocks in the d[illegible]am.

Primary Hazards

- Primary h[illegible]uring the earthquake, i.e. ground shaking and cr[illegible]op[illegible]n, and ground displacement.
- Ground [illegible]king causes buildings to sway and collapse (especially horizonta[illegible] movement), and damage to infrastructure such as roads and railway lines, pipelines and cabling.

Secondary Hazards

- Secondary hazards occur after the earthquake. They are often a result of the primary hazards, e.g. **liquefaction, avalanches and landslides**, and human effects caused by the destruction of buildings and important infrastructure, and things like the outbreak of fires from broken gas pipes and upturned stoves.
- Liquefaction is where the saturated unconsolidated material such as soil acts as a fluid. The loss of strength causes buildings to tip over, and river banks to collapse. Water can pool on the surface, causing flooding. The photo shows flooding caused by liquefaction.

E.g. Christchurch, 2011; K[illegible]95

- Landsli[illegible]e [illegible]erous because debris can block roads – blocking the pr[illegible]
- People [illegible]ling skiers and climbers, can become trapped in sudden avala[illegible]

E.g. Avalanche, Mount Everest base camp, 2015

Tsunami

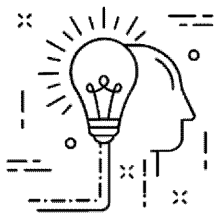
- **Tsunami** are a secondary hazard.

What is a tsunami?

- Tsunami mainly occur in the Pacific Ocean as a result of underwater earth[illegible]
- They are caused by uplift of the seabed and underwater landslides.
- They are waves which gain height as they reach the shore.
- They travel for several kilometres inland, caus[illegible]d spread flooding ar[illegible]

E.g. In[illegible]c[illegible]n, 2004; Japan, 2011; Indonesia, 2018

If you only remember these three th



1. Earthquakes are the shaking of the ground as rock waves propagate away from the focus. The depth the effects and energy at the surface.
2. Earthquakes are part of the mountain-building pro ground, resulting for example, in escarpments and
3. Hazards are either primary or secondary. Primary shaking and cracking during the eruption, and seco liquefaction and tsunami, result from the primary e secondary effects which affect humans.

Activities

Consolidation questions

1. What is the epicentre of an earthquake?

.....

.....

2. Which type of earthqua[illegible] occur at convergent boundaries, that is not fo[illegible]

.....

3. Identify the landform in the image below. Note that erosion and mass move[illegible] feature since its creation.

.....

4. Why can buildings collapse during earthquakes?

.....

.....

5. Why are fires a secondary effect of earthquakes?

.....

.....

Take it further

Why are tsunami so d[illegible]
zzed.uk/[illegible]

Student checks

Topic	What Do I Know?	No Idea ☹	Nearly 😐	Sure ☺	
Earthquake Causes, Features and Hazards	What are earthquakes and why do they occur?				
	Seismic waves				
	Types of earthquake				
	Earthquake scales				
	Impacts on the landscape				
	Primary hazards				
	Secondary hazards				
	Tsunami				

Why Do People Live in H
Areas?

Key words

- ✓ **Natural hazard:** A danger to life c... vi... t the influence of humans; fo... volcanoes and earthquakes
- ✓ **Disaster:** Result of su... ...lging and sometimes life-threatening events.
- ✓ **Percepti...:** T... ...at a person sees hazard risk – dependant on persona...
- ✓ **Fata...** ...elie... that hazards and events are beyond a person's control and...
- ✓ **Vulne...y:** The degree to which a population is liable to be affected by ... able to resist the disaster.
- ✓ **Active volcano:** Either a volcano that is currently erupting, one that scientists ... that has erupted in the last 10,000 years.
- ✓ **Dormant volcano:** A volcano that has not erupted for thousands of years, bu...

Key points

- People perceive hazards differently depending on their personal experienc... and beliefs such as fatalism.
- Each country can cope with hazards in different ways based on their financia...
- People choose to live in tectonically active regions – for the fertile farmland ... tourism. Others stay for the friends and family connections to the area. Some ... stay because the benefits outweigh the perceived risk. Globally, relatively fe... volcanoes, and many don't erupt very often. So... people choose to live on ... high population density.
- Volcanoes can bring economic b... ti... t... country – tourism, mineral wea... different story if they e... however.
- Earthquakes oc... ...gs... volcanoes, or on their own. Cities developed in ... befo... ...nd... standing of plate tectonics. The threat of earthquakes is a w... accep... risk, especially by those moving to tectonically active regions such ... fact that people rebuild after earthquakes in exactly the same place shows h... the area where they live.
- The challenges faced and reasons for living in active countries vary dependi...

Hazard Perception

People across the world view hazards differently. There are <u>two main areas</u>.

Economic

- Volcanoes can provide employment – mining, farming and tourism.
- Hazardous places can be nice places to live – e.g. California.
- Cost–benefit analysis.
- Might (not) be able to aff... ...e.

- Religious b... will)).
- Friends an... families m...
- Fear and ...

Also:

- People ... country will perceive their risk (**vulnerability**) differently – base... age, gender, health, family (e.g. parents vs single people) and level of educa...
- <u>Personal experiences</u> – based on past events.

- Country wealth – the more advanced the country, the more choice citizens
chance of reducing losses / reducing fear through **mitigation**, **planning** an
might be able to **predict** hazards with more success than others.
- No two hazards are the same – it's difficult to compare two events – the inte
physical factors are so complicated.

Why Do People Live in Volcanically Active Regions?

- People choose to live on volcanic islan[illegible]se of the economic opportu
  - fertile soils and multiple[illegible]year
  - jobs in mining ([illegible] dangerous and in poor conditions)
  - jobs [illegible]ur guides, hotel workers and other support services)

E.g. Volcanic islands include Indonesia, the Philippines, Japan, H

E.g. Farming and touri[illegible]awaii, dangerous sulfur mining o

- They m[illegible]nt[illegible]ive in the area where they were born, having friends
jobs ar[illegible]es.
- Some people may want to move, but can't afford to.

Impacts on people

- Unlike earthquakes, the source of volcanic hazards is immediately obvious.
- Hazard management is getting better – meaning that risk is being reduced.
- Residents grow up living near volcanoes – the presence is always there, and some may believe in fatalism. While some volcanoes erupt without warning, there are often signs leading up to an eruption, giving time for people to prepare and evacuate.
- Many volcanoes erupt infrequently so are said to be **dormant**. Many volcanoes [illegible]ave erupted in living memory.
- Volcan[illegible]tu[illegible]affect relatively few people each year. H[illegible]r, they can still be deadly. Lives, land and property can all be lost from lava and pyroclastic flows, lahars and floo

Image courtesy of Goog
Association.

E.g. Aerial photo shows settlements surrounding Mount Fuji, Jap
last erupted in 1707.

Impacts on the country

- Economic prosperity from farming, mining, and also cheap and clean geoth
  emissions! The plentiful food supplies can support large, dense populations
- However, large eruptions can devastate a local area – displacing citizens an
  reduced tourist income, or cash crops, etc.
- Volcanic eruptions, such as lava, pyroclastic flows and ash fall can cause wid
  ecosystems surrounding the volcano – however, de[illegible]tion is short-lived –
  as plants recolonise the new surface.
- Politically, some countries may req[illegible]ancial assistance from other, weal

Why Do People Live in Earthquake-prone Regions?

- Earthq[illegible]a[illegible]occur where there are volcanoes at divergent and con
  there a[illegible] benefits created through volcanic activity.
- But what about boundaries where there is no volcanism – conservative bou
  Andreas Fault in California? In cases such as this:
  - Large historic towns and cities were built before the understanding of
    important physical factors such as rivers, flat land and ports. The house
    are all in place.
  - The area is a beautiful place to live – people enjoy living there and are
    through cost–benefit analysis).
- Of course, development and beliefs are the same as for volcanic eruptions –
  available. Many people accept the risk – they perceive the chances of being
  and many areas have different types of hazards.
  - For example, some people may move to California from areas where th
    seasons, or other weather hazards. They perceive the threat of earthqu
    hurricanes.
- Similarly, there are issues of friend and family ties, and financial capability to move.

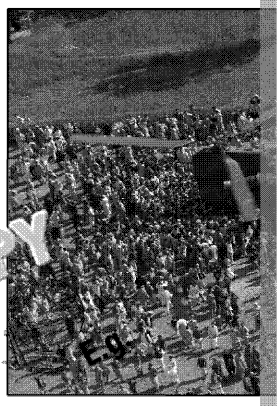
E.g. [illegible]Francisco was [illegible]uilt in exactly the same location after a devastating earthquake in 1906. The next largest quake was in 1989.

Impacts on people

- People still migrate to earthquake-prone regions – for jobs and to raise fam
  earthquakes is always there, but people adapt – for example, by learning ho
  and prepare for them.
- Many people who experience earthquakes find their first few scary – but th
  quakes and their aftershocks.
- When earthquakes do occur, the effects and loss of life[illegible]an be severe. This is
  areas where tsunami have occurred.

Impacts on the country

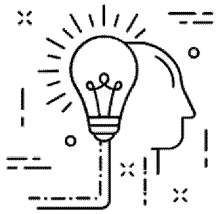
- Monitoring equipment can be expensive. So too is the building of shelters, and the planning and training of personnel to respond to earthquakes.
- Rebuilding after earthquakes and tsunami can be very, very expensive. Some countries may be able to rebuild using internal finances – others may not. Earthquakes can cause big political issues.



E.g.

The photo shows aid being delivered by helicopter to Haiti. Haiti is classed as a developing / emerging country, and has struggled in this case to accept aid from the United States. All of those [illegible] such as food, seen from the way they are descending on the helicop

If you only remember these three th



1. Each person perceives risk differently, depending personal experiences and circumstances. People c the level of risk, especially those actively migratin may be unable to move because of their finances.
2. There are many benefits that volcanoes can bring economic income, and unlimited sources of geothe affect a very small percentage of people on a gl
3. Earthquakes either occur together with volcanoes, or depending on the type of plate boundary. Major tectonically active regions before the understandi [illegible] there are many people who still move to tecto opportunities and otherwise pleasantness of the lo

Activities

Consolidation questions

1. Why might a person's perception of hazards change over their lifetime?

.....

.....

2. What types of jobs can tectonics provide?

.....

.....

3. Why might people be forced to live in tectonically active areas?

.....

.....

4. Why did settlements develop in hazardous areas?

.....

.....

5. Give an example of how we know that people are happy living in areas pro

.....

.....

Take it further

Here's an article about living in Japan with the threat of hazards:
zzed.uk/9989-tokyo-earthquake

Student checks

Topic	What Do I Know?	No Idea ☹	Nearly 😐	Sure ☺	
Living in Hazardous Areas	Hazard perception				
	Why people live in volcanically active regions				
	Impact on people				
	Impact on the country				
	Why people live in earthquake-prone regions				
	Impact on people				
	Impact on the country				

Protecting Ourselves fro

Key words

- ✓ **Mitigation:** Reducing the effects of a disaster – such as building strong, earth buildings or zoning land use based on hazard risk
- ✓ **Adaptation:** Coping with the effects of a te[illegible] hazard and changing the w
- ✓ **Planning:** Preparation for an even[illegible] responses to immediately spri disaster occurs in order to d[illegible] event as quickly as possible.
- ✓ **Short-term respon[illegible]:** other actions provided immediately after an e ensurin[illegible] are looked after.
- ✓ **Long[illegible]esponse:** Aid and rebuilding that takes place up to years after housin[illegible] quality of life to a normal level.
- ✓ **Perception:** The way that we see risk – and, therefore, how we react to it.
- ✓ **Effects:** The results of a hazard to people, the economy and the environment.
- ✓ **Hazard management:** Taking steps to reduce the impact of a disaster – for preparation, land-use zoning.
- ✓ **Community preparedness:** The temporary movement of people away from areas as part of preparation for a disaster.
- ✓ **Prediction:** An estimation of when an event (such as an earthquake or volcan on past and current knowledge.
- ✓ **Hazard mapping/zoning:** Classifying areas based on risk to inform manage
- ✓ **Evacuation plan:** Plan to temporarily move people from a hazardous area t quickly undertaken before or as a disaster happens.
- ✓ **Insurance:** A premium is paid each year so that after a disaster, damage ca losses rectified at a cost not borne by an individual.
- ✓ **Compensation:** Money provided (e.g. by a governme[illegible] in order to cover lo businesses and property.
- ✓ **Hazard:** Threat of an earthquake or v[illegible]ni[illegible]ption.
- ✓ **Disaster:** When the event occu[illegible] – [illegible]azard is realised.
- ✓ **Magnitude:** The size of [illegible]ven
- ✓ **Intensity:** The le[illegible] the event occurs – e.g. a volcano that erupts for
- ✓ **Spati[illegible]rib[illegible]on:** The pattern that events occur in.
- ✓ **Frequ[illegible]:** How often a hazard of a particular size will occur.
- ✓ **Hazard risk equation:** Risk = hazard likeliness x level of vulnerability.
- ✓ **Park model:** Graph displaying the speed and magnitude at which quality of and the speed and level of recovery afterwards.

Key points

- We do our best to predict when and where disasters might occur – the proce Therefore we need to prepare – by adapting to life with hazards to cope w lessen their effects. But they're also hard to mitigate – and we certainly can't
- Perception and vulnerability can be strongly linked to the level of developme
- Hazards can affect countries differently – again, this may be linked to the le
- To deal with hazards we try to reduce the seve[illegible] the event, reduce our v losses.
- Responses to events are either [illegible] (immediate), or long-term, sometim event.
- People are pr[illegible]y the state, their community, and their own actions.
- Some[illegible] responses to volcanic eruptions and earthquakes are the same.
- For vo[illegible]eruptions we **mitigate** by using barriers to deflect lava and lahars, monitoring, training, planning and building shelters, and reduce the **loss** through

Key points (continued)

- For earthquakes we **mitigate** by zoning the land based on risk and hazards, **vulnerability** by monitoring, planning and building shelters, and practising e making buildings earthquake-resistant, and reduce the **loss** through emergen aid, insurance and compensation.
- Hazards and disasters are different. Hazards becom sasters when an eve earthquake or volcanic eruption occurs.
- While we cause some earthquakes a n't have any control over volcanic number of such events is fairly s but human factors are increasing the ri hazards as populatio s and more people live in hazardous areas. T each ye va e se of major events such as tsunami. Overall, the numb whe er hazards are included – as a result of climate change.
- There ts of factors that affect the scale of a disaster, such as when and hazards occur in an area.
- The hazard risk equation assesses the risk of a hazard to a particular group
- The Park Model can be used to show how quality of life is affected by a haz deterioration and the speed/amount that a country can recover is linked to th

Reducing the Risk

There are many ways that we can reduce the effects from hazards, including:

Prediction
Using scientific methods and monitoring to predict when and where the disaster will occur. This is difficult, and sometimes impossible!

Mitigation
Trying to reduce the effects of a disaster – for example, land use planning, policies and design, and provid s. elters.

Plan
Ensuring as s are in place to ensur actions during an event – s elters are maintained, personnel are trained and evacuation routes are planned.

Risk sharing
A community works together to mitigate the effects of a disaster, for example, ensuring that rescue plans are up-to-date and local residents know how to respond.

Sometimes, a country might not be able to cope with a disaster on their own. Th the international community for support – other governments and charities.

These can be divided into three broad categories, which are:
1. reduce the severity of the event
2. reduce the vulnerability to the event
3. reduce the loss from the event

Some of the methods in these categ s are ly to both volcanic and earthquake specific to the type of expect even

- For example, ed t the public on how to respond to events is applicabl deflec no e at a conservative boundary.

The scale and success are related to the level of economic development of the a

We'll look at all three in the context of both volcanic eruptions and earthquakes.

Can We Prepare for Volcanic Eruptions?

Yes, there are lots of ways that we can prepare (see below). These include planni the effects (reducing their effects) and adapting (changing lifestyles).

When eruptions occur, there are two types of responses.

1

Short-term responses

Before and after the eruption.
Include evacuation, shelter, provision of emergency (medical, fresh water) aid, food and water, search and rescue, etc.

May be carried out by the affected country, sometimes the international community.

Long

Occur after the
on returning the
restoring service
rebuilding home
for future event

May require as
international co

Mitigation against the severity of the event

- Build lahar, lava or pyroclastic flow barriers, dams, channels or deflectors, or flow – such as water-spraying to cool the lava.

Vulnerability and community preparedness

- Volcanoes can show signs of erupting. But we obviously can't predict exactly when a volcano will next erupt. We try to **monitor** signs of an eruption by measuring:
  - earth tremors
  - changes of shape
  - gas emissions
  - steam temperature
- Build and maintain shelters.
- Evacuate people in front of lava, pyroclastic and mudflows and ash fallout.
- Stockpile supplies and ensure emergency personnel are on standby.
- Community preparedness can involve maintaining local shelters and equip

Adaptation

People can help to protec

- learning their escape
- ensuring that they ha supplies of food, wa aid, etc.
- following orders dur evacuating

E.g. The United States has a National Volcano Early Warning Syst United States Geological Survey (USGS).

Mitigation against losses

- Use the short-term responses listed above – e.g. shelters, search and rescue
- Rebuild – the long-term responses.

Can We Prepare for Earthquakes?

Yes! But we don't get much (if any) warning, so the years of planning and prepar
immediately.

Responding to earthquakes:

Short-term responses

These occur immediately after the ground h
stopped shaking.

E.g. evacuation, shel
emerger
water, se
collapsed
prevent disease spread

Lon

Occur after the

Focus on returni
normality – rest
infrastructure, r

Include planning
zoning, etc.

If a country can't cope with the effects of an earthquake, it may call on the inter
community for help – governments, charities and NGOs.

Following the earthquake in 2010, Haiti relied on assistance from the internatio
community.

Mitigation against the severity of the event

- There's no way of stopping earthquakes. The best way is to zone the land based on risk. Zoning and mapping allow us to stop building in the places that are most at risk, including on soft ground where liquefaction is likely to occur.

Vulnerability and building design

Vulnerability can be reduced by:

- Land-use zoning
- Drills in
- Trainin
- Setting up and maintaining emergency shelters

'Earthquake proofing' (making the city and its buildings as resistant as possible). Examples may include:

- Building codes
- Resistant new buildings and retrofitting existing ones (e.g. building materials, shape, structure, spacing, cross-bracing, counterweights, shock-absorbing foundations, location).
- Gas shut-off valves
- Tsunami walls and warning systems.
- Earthquakes are impossible to predict. Sometimes we can estimate the ge
earthquake might occur, but we can't know when or
- Sometimes there are smaller '**foreshocks**' rel
event. And after the e

E.g.

In the Japan
days
on 9th March.

Mitigation against losses

- Again, the short-term responses are applicable here.
- Also includes the long-term rebuilding, which can be assisted by:
  - **Insurance** – a way of financial protection against a disaster. If an insured business, for example, is damaged by a natural haz... the insurance compan... pay for repairs (of course th... ess has to pay an a... ee called a premium). Some ins... don't cover natural hazards or may exclude some of the effects because of the high costs and risk of lots of people claiming at the same time. There are sometimes policies insurance' to cover natural hazards.
  - **Compensation** – including provided by governments to cover the loss

Adaptation

Residents can:

- Know what to do duri... der desks instead o...
- K...ow their nearest ev...
- Secure their homes – e... etc.
- Prepare a grab-bag (... first aid).
- Download apps to rec...

And importantly, they need...

What are Hazards and How Do They Differ from Dis...

- We don't have control over natural hazards.
- Hazards and disasters are not interchangeable.
- Hazards can damage or end human life, property, infrastructure and the environment. They have **socio-economic consequences**.
- They are often violent, and occur with little warning.
- They affect large areas of the world. In some are... people have little choice and must live with the risk...

The thr... occurri... te...

When t... reality...

Luckily, the larger the event ti... ew... there are and the less chance of them occu...

Have th...sks from Hazards Changed over Time?

- Some earthquakes are caused by human activity such as fracking, mining a... most earthquakes and volcanic eruptions are natural. We can't stop them fr...
- Therefore, the number of tectonic events is fairly constant.
- More people are affected by major disasters such as large-scale volcanic eru... tsunami, meaning that the number of people affected varies each year – so...
- The number of people affected by tectonic events will further increase beca... more people moving into areas at risk of hazards.
- When you include other hazards, such as climate and weather, the overall n... affected is increasing because of human activity and climate change.

The Effects of a Disaster

- Disasters affect people (social), the ec... my, the environment and political...
- We can divide the effects in... p... ...y and secondary effects. Sometimes, th...

1

Primary

- Occur as event is still happening – limited to a very brief moment in time – these are the initial **effects**.

- Occur after t... and hours a...
- Are the resul...

What are the Physical Factors Affecting a Disaster?

There are many physical reasons why hazards have different effects. Examples in

- The **magnitude** (scale) of the event.
- The **intensity** (speed of onset on the area affected) of the event.
- The **spatial distribution** – where the event occurs – near to large cities or in re
- The **geology** of the region (in relation to earthquakes).
- The **time of day**, **day of the week**, and **time of** … whether people are … school or work, or out in fields harvesting
- The **frequency** – how often a di… …es an area.

The Hazard Ri… Equation

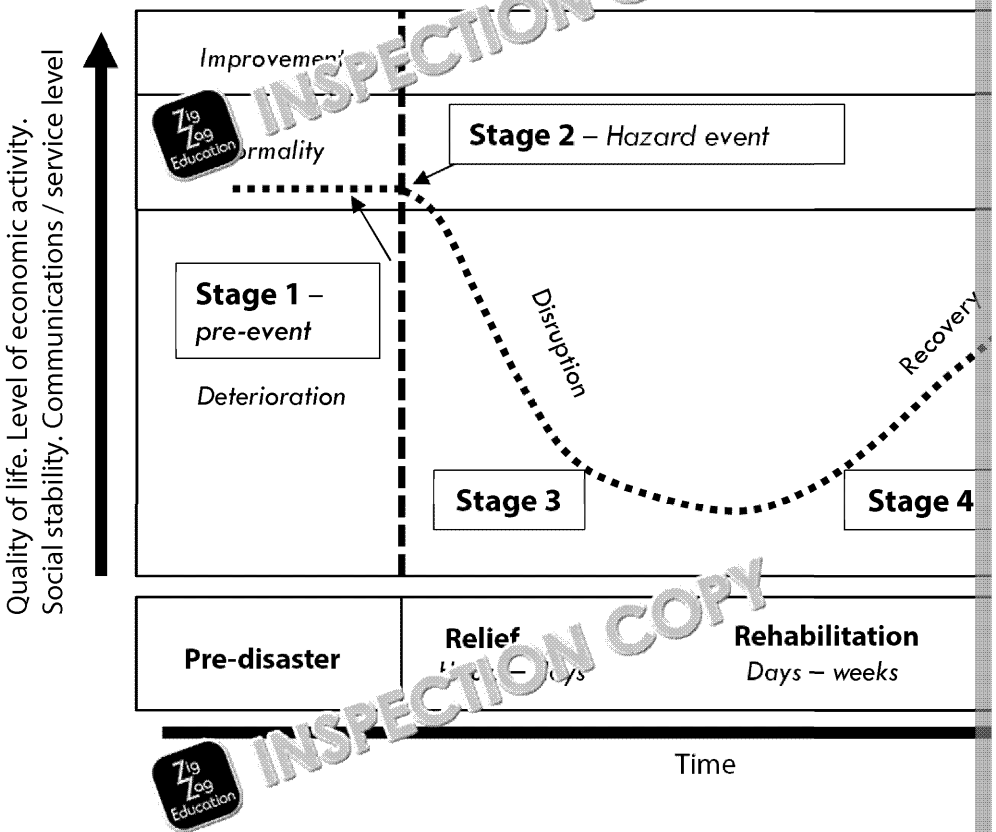
- One m… …assess the risk of a hazard to a group of people is the hazard … differer… …sions, for example:
  - risk = hazard likeliness x level of vulnerability
  - risk = probability of the hazard x loss (damage)
  - risk = (hazard x vulnerability) ÷ capacity
- The model can be used to compare two different countries.

The Park Model

Shows how the quality of life changes after a disaster has occurred. There are fiv…

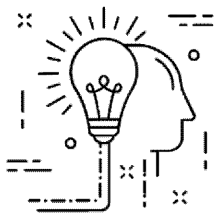
The model shows resilience – the ability for people, countries and communities … Sometimes, countries can't reach pre-disaster levels, sometimes they return to th… they improve.

The shape of the curve – the steepness and level varies … …nding on factors su… slower onset might mean a greater decrease and … …verall quality of life.



We can use the Park Model to compare hazards in different countries. The mode… on the level of development – for example, how much deterioration occurs, the … of recovery. Countries at lower levels of development might be expected to rec… reach the previous quality of life.

If you only remember these three th



1. We do our best to prepare for disasters through r order to reduce the severity, vulnerability and los are short-term and long-term, and vary between we are, the less likely th e azard will develo
2. We have little ntr over where and when a vo earth ake occur. We can cause a few earth has stayed broadly the same, but the ef depending on whether there are major events. Hu risk from hazards.
3. We can calculate risk, and also use the Park Mod is affected by a disaster, and how the area is like

Activities

Consolidation questions

1. What are the three categories that we can use to mitigate and adapt to haz

.....

.....

2. What's the difference be[illegible]en short-term and long-term responses to an e

.....

.....

3. Give an example of how we can reduce the severity of a volcanic eruption.

.....

.....

4. Why is public education important in earthquake preparation?

.....

.....

5. What does the Park model show?

.....

.....

Take it [illegible]he

Hazards and how to survive a volcanic eruption – BBC Earth Lab (5:24):
zzed.uk/9989-bbc-survive-eruption

Student checks

Topic	What Do I Know?	No Idea ☹	Nearly 😐	Sure ☺	
Protecting Ourselves from Hazards	Reducing the risk				
	Preparing for volc… erupt…				
	Preparing for earthquakes				
	Hazards vs disasters				
	Changing risks over time				
	Primary and secondary effects				
	Factors affecting the risk				
	The hazard risk equ…				
	The Park Model				

Case Studies (blar

Volcanic Eruptions

	Developing/emerging country	D
Location		
Magnitude of the event		
Descript the event (e.g. damage caused, socio-economic effects, cost of total damage)		
Mitigating against the event		
Mitiga against vulnerability		
Mitigating against losses		
Reasons e events different		

Earthquakes

	Developing/emerging country	D
Location		
Magnitude of the event		
Description of the event (e.g. damage (, socio-eco effects, cost of total damage)		
Mitigating against the event		
Mitigating against vulnera		
Mitigating against losses		
Reasons why the events were different		

Case Studies (indicative

Volcanic Eruptions

	Developing/emerging country	D
Location	Mount Merapi (Indonesia), 2010	Eyjafjallajökull
Magnitude of the event	VEI: 4	VEI: Phase 1 –
Description of the event, damage caused, socio-economic effects, cost of total damage)	Th[illegible] collapsed and ash fall was 30 cm. Pyroclastic flows raced down the mountainsides, and lahars followed. Flights were cancelled and Mandala Airlines declared bankruptcy. Cost $450 to $650 million.	Volcanic ash w atmosphere (g the eruption ta 107,000 flights industry £1.1 b were disrupted disrupted supp
Mitigating against the event	Local people are drawn to the mountain because of its fertile farmland. Some locals perform rituals to prevent volcanic eruptions, believing that supernatural elements live at the summit – some even bury buffalo heads at the summit – but this is belief rather than a scientific method.	While not esta examples coul lava, lahars an
Mitigating against vulnerability	Education is essential in allowing people to understand why they need to evacuate – for example, people have refused to evac[illegible] warning signs aren't obvious. In[illegible] leaders can be used to help persuade people to evacuate. In [illegible] the government started evacuating cattle. Cows are the main source of income so people sometimes refuse to evacuate, or go back to feed their cows during an eruption. In 2010, the government bought the cows to stop people returning home.	The Departme Emergency Ma communicatio government, p had no hazard meaning that essential. Othe detail on the e and agricultur Websites were advice and kee
Mitigating against losses	400,000 people were evacuated (saving up to 20,000 lives) but there were still around 379 deaths and 450–600 injured. 114 refugee camps were established. Rescue teams were used, but some members were also killed by pyroclastic flows. NGOs were involved with emergency aid.	500 people we deaths. The aircraft we could have me Emergency pla evacuation pla implemented.
Reasons why the events w[illegible] differ	We can see the differences in culture b[illegible]en the two countries trust scientists and governme[illegible]t – th[illegible]y are less likely to stay beh The two ever[illegible]e[illegible]y different, which is why it's difficult to d same [illegible]e – Iceland saw major air travel disruption across [illegible]here, amounting to huge economic cost – the level of dev effect on this. The low population density in Iceland could perhaps account for evacuated or the number of deaths – but generally the higher th and fatalities.	

Earthquakes

	Developing/emerging country	D
Location	80 km north-west of Kathmandu (Nepal), April 2015	The Japan Tr from Japan's
Magnitude of the event	7.8 Mw	9.0 Mw
Description of the event (e.g. damage caused, socio-econ ic effects, total dam ge)	50 seconds of ... (plus frequent after... ...ides and avalanches Cost of US $5 billion	Six minutes o because of th Cost of US $3
Mitigating against the event	The earthquake showed aid agencies the importance of Crowdsource and 'big data', such as Person Finder.	Japan has an warning syste
Mitigating against vulnerability	Many of the buildings in Nepal were old and vulnerable to the earthquake.	Special Zones established t reconstructio government to provide ad Japan has str earthquake-r
Mitigating against l...	There were 8,969 deaths after b... earthquakes, 17,866 people inj...d and 602,592 houses de...troyed. Fi...al aid, rescuers, medical aid, supplies ...nts, blankets, tarpaulins, etc.), food and water, and transport were provided. The army responded, and the international community responded to a call for aid.	100 deaths fr 16,000 from t 6,152 people destroyed. Food, water, fuel, etc. were used, and mil countries wer Red Cross do
Reasons why the events were different	The two events are difficult to compare – a traditional earth tsunami. Tsunami are incredibly damaging to the coastal c travel far inland. Even similar magnitude events in two cou effects based on timing, location, etc. However, there are g make – such as a higher death toll (but lower financial cost) greater reliance on the international community. In this cas the earthquake alone were small, compared to the deaths f from the number of houses destroyed in Nepal, that Japan' – design must be successful.	

Exam Advice

Time management

If you open the paper and see a question you didn't expect: don't panic! Take a
follow the steps below. Whatever you do, don't just sta ting down everythi

Before you rush headlong into the exam n moment to look at the question

Re din hole paper

- Rem o take your time at the beginning, readi ugh all of the questions.
- You don't have to answer them in any particular order, but be aware that sometimes AQA order the questions for a reason, and earlier questions might help you answer later ones.

Reading th

- Too often stude and lose marks
- It might be usef and command w what the questi

Planning

- After reading through the question, make sure you plan your answer.
- This stage is key to getting higher marks, so make sure you don't skip it. Planning can help you:
  - structure your answer
  - answer the question properly
  - save time
- You may do any ro d planning in your e pa ake sure to ~~put a line thro~~ o indicate it is not to be marked.

- Remember to p spelling, gramm as content.
- You can use as need, but try to quantity when i be put off by h around you.
- Any mistakes y don't use corre
- If you get stuck go onto anothe back to it at the
- Adopt a forma and concisely.
- Your introducti issue at hand, g information.
- The body of yo evidence for yo the points you For long-answe demonstrate yo recommendatio need to present viewpoints.

Checking

- Leave some time after to go through your answers, correcting spelling, grammar and terminology errors and making sure you haven't left anything out.
- Finally, double-check that your candidate details are on any extra sheets you may have, and put them in the correct order with your answer book, using a treasury tag to attach them if you need to.
- Put a cross through any pages you d nt marked, e.g. planning pages

Geographical terms

One of the points you are being assessed on is the correct and appropriate use o
geographical terms. You should have assembled a list of key terms that might b
useful for this exam, so make sure you learn them and think about how you migl
include them in your answers. If you are scared of forgetting these words when
start writing your answers, you could try writing them down as soon as you ar
permitted to start writing – remember to cross them out at the end though!

However, don't use geographical terms if they are unnecessary or you are unsur
include the[re] only when they are relevant and useful.

Getting the tone right

As well as using key geographical terms in your answers, your writing should stri
This helps your answers appear considered and professional.

Do ✓	D
• Write out abbreviations in full the first time you use them • Be clear when a statement is a personal opinion as opposed to fact • Use linking words: thus, therefore • Try to include the source of a fact if you can, e.g. according to the WHO, the death toll from the tsunami was 1,200	• Write in the first p • Use contractions • Use slang terms a • Use rhetorical que

It might help to think of yourself talking to the examiner, or a geography teach
don't know you, so you need to make sure you are clear, but they do know abou
to explain every key term you use – it's not necessary.

Ask your te[acher] if you are unsure about your current 'tone', but don't worry ab
are more focused on how you answer the question.

Spelling, punctuation, grammar and legibility

It can often be hard to think about these in the exam hall, but proper spelling, p
and grammar really help keep your meaning clear. They also keep your sentenc
getting too long, which aids with clarity and readability.

While examiners are used to reading all sorts of handwriting, it is good to try to k
answers as legible as possible. One way to do this is to slow down while writing,
letters are an appropriate size. The final read-through of your answers before fi
any words which are especially tricky to read.

Quality over quantity: writing skills are only important in that they he
meaning clear and communicate your geographical knowledge and u
have a focused and clear answer than a waffled answer stuffed with co
question.

In the event of emergencies!

- All your planning and preparation means this isn't going to happen... But if the first rule is always to try to relax!
- Take a minute for some deep breaths, close your eyes and imagine a lush, g woodland... Clear your mind.
- Now read over the question, think over what you ha[illegible]t said yet, and cont

'Thinking like a geographer' and 'synopticity'

Learning to 'think like a [illegible]' is crucial for exam success and important fo

As you are aware, the world is a complicated place – cause and effect, and a pull information together, join up the dots, and work out why things happen in include space, place, environment and scale.

Don't be afraid to draw on your own knowledge and other modules to help illus creative, original and innovative, but use this skill wisely. Make sure you use that question rather than going off on a tangent or writing down *everything* you kno called '*synopticity*'.

Here are a few tips on thinking like a geographer:

Consider the many aspects of the issue from many

- Think across the social/natural divide, using your knowledge of bo geography.
- Involve many aspects of the issue: hi[illegible] context, cultural pers
- SPEED can be a useful tool for [illegible]ing synoptically: social, politic environmental, and demographic. But don't forget to consider cul material fa[illegible]s when appropriate.
- Try [illegible] the issue from many viewpoints: work on your empathy
- Don[illegible] afraid to think outside the box!

Spatial concepts

- Geographical perspectives often focus on the importance of space, lo issues at hand.
- Think about movements and flows of people, goods, ideas, etc.
- Think about the effects of 'scale': local, regional, global.

[illegible]tive

As long as your approach is logical [illegible] well justified, you can think inn

Exam pr[illegible]ation

My take-home tips:

- ✓ Before the exam (Eat a good BREAKFAST)
- ✓ During the exam (Read the question CAREFULLY)
- ✓ Planning (HIGHLIGHT key words and concepts)
- ✓ After the exam (Take some time to RELAX!!!)

Answers to Consolid Questions

Plates, Movement, Earth's Structure and Plate Boundari

1. The outer core.
2. During the twentieth century – Alfred Wege[illegible] noticed the fit of continents striping and mid-ocean ridge[illegible] discovered later.
3. They are oceanic pla[illegible] therefore subject to gravitational sliding an
4. The sam[illegible] crust must be destroyed at convergent boundaries.
5. Rift va[illegible]

Volcanoes – Causes, Features and Eruption Hazards

1. Effusive – runny magma from the mantle, rather than from melted crust.
2. Explosive – thick, sticky magma at convergent boundaries, which explodes
3. The crust is thinner, magma can break through.
4. No – the eruptions occur very infrequently.
5. A pyroclastic flow because of the speed.
6. Lahar or glacial outburst flood.

Earthquakes – Causes, Features and Hazards

1. The point on the surface directly above the focus.
2. Deep-focus earthquakes.
3. Rift valley.
4. Result of liquefaction, and horizontal ground mo[illegible] causing them to sw
5. They occur after the ground has stopped sh[illegible]nd result from the dama shaking – e.g. a fractured gas pip[illegible] upturned charcoal stove.

Why Do Peopl[illegible] in Hazardous Areas?

1. May h[illegible] perceived hazards, personal circumstances change – e.g. want
2. Farmin[illegible]ing and tourism (both direct and indirect).
3. Need jobs located in the area, may not be able to afford to move.
4. Developed before the understanding of plate tectonics – based on the natu
5. People are still migrating to the area / people rebuild in exactly the same pl to them, the benefits outweigh the risk.

Protecting Ourselves from Hazards

1. Reducing the severity, vulnerability and loss from an event.
2. Timing and type of response – short-term are immediate and aimed at pres while long-term focus on the rebuilding side.
3. Trying to deflect lava flows and lahars, etc. from major settlements, etc.
4. Ensure the public respond in the correct ways because they could otherwis themselves.
5. The change in quality of life after a disaster [illegible]nd how it returns to normality.