IGCSE Geography

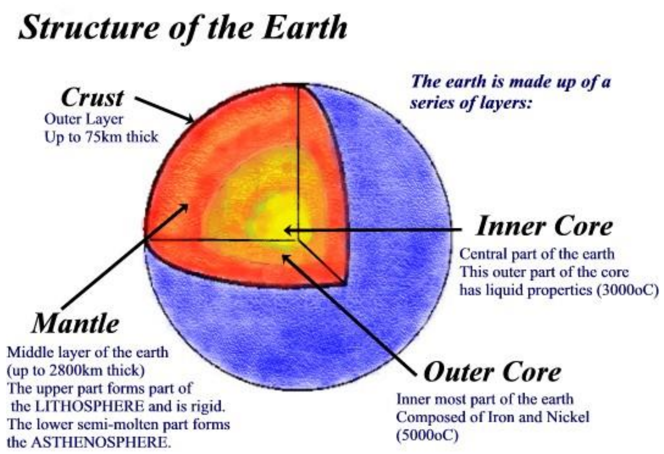
What are the Key Ideas for this Topic?

- ***Tectonic Plates***
- ***Fold Mountains***
- ***Types of Volcano and Super Volcanoes***
- ***Earthquakes and their effects: LEDC's VS MEDC's***
- ***Tsunamis: Causes, effects and responses***

Tectonic Plates

Tectonic Plate- a huge section of the Earth's crust

Convection Current- a current caused by movement by **CONVECTION** of warmer fluid into an area of cooler fluid.



There are **TWO** main types of plates:

<u>Continental Plate:</u> (e.g. Eurasian Plate)

- Thick and less dense than Oceanic Plates
- Mostly Made of Granite
- They are those Situated underneath bodies of land (Continents)
- Very Old- 1,500 million years old

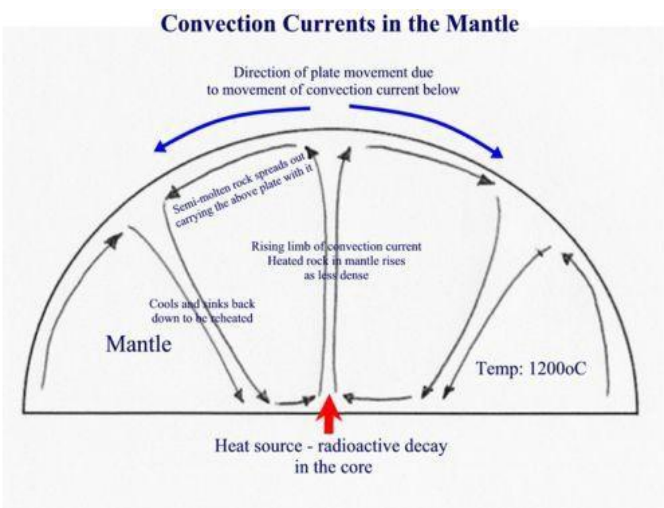
<u>Oceanic Plates:</u> (e.g. Pacific Plate)

- Thinner and more dense than Continental plates
- Mostly made of Basalt
- Flat and are situated under large bodies of water e.g. Pacific Ocean
- Younger than Continental Plates- 200 Million years old

<u>What Causes Tectonic Movement?</u>

Tectonic movement is caused by **Convection currents**:

- The radioactive decay that is happening in the core heats up the mantle which rises as it is less dense.
- The semi-molten rock spreads out and carries the plate above with it.
- This sideways motion moves the Crust's Plates.
- After movement, the mantle cools and sinks back down to be reheated in the core.



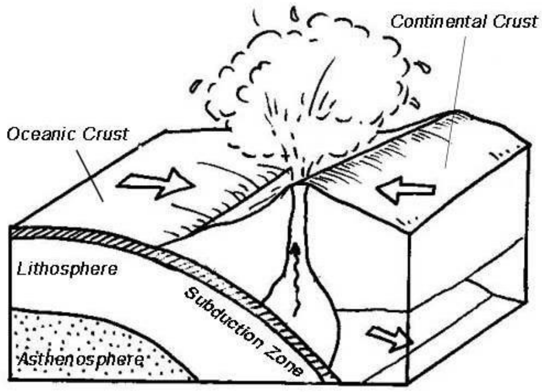
<u>The Three Different types of Plate Boundary:</u>

- The point at which plates meet is known as a Plate Boundary
- There are **THREE** Types of Plate Boundaries:

Destructive Plate Boundaries

***E.g.* Andes, south America:** Nazca plate sinking underneath the South American Plate

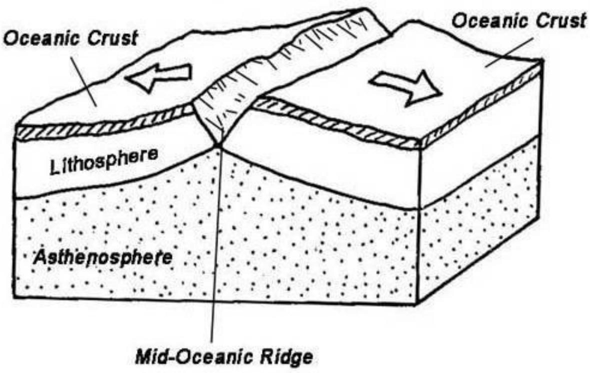
- These are plates that move **towards** each other.
- One of these plates (the denser Oceanic Plate) sinks below the Continental Plate.
- The denser and thinner Oceanic plate is pushed downwards and is forced into the Subduction zone where there is great amounts of heat + Pressure.
- The energy from the subduction zone may be released as an earthquake.
- The molten rock may rise to form composite volcanoes.
- The lighter crust on the surface may crumple to form Fold Mountains.



Constructive Plate Boundaries:

E.g. America's moving away from the Eurasian and African Plates - formed the Mid-Atlantic Ridge.

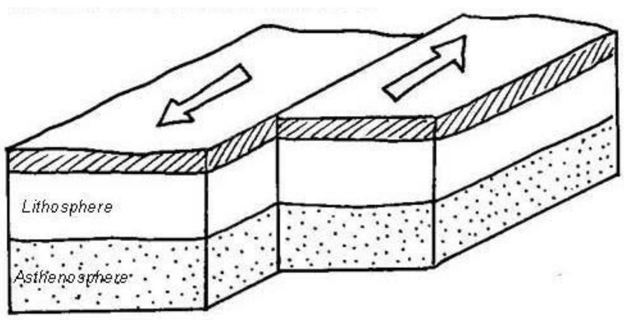
- Two plates that move **away** from each other. (Two the same i.e. Two Oceanic or Two Continental Plates)
- Magma rises from the mantle to fill the gap. It then cools to create a new crust.
- The Rising magma forms shield volcanoes.
- This is most common under oceans so sometimes volcanic islands are formed.
- Sometimes, the plates buckle to form ridges.



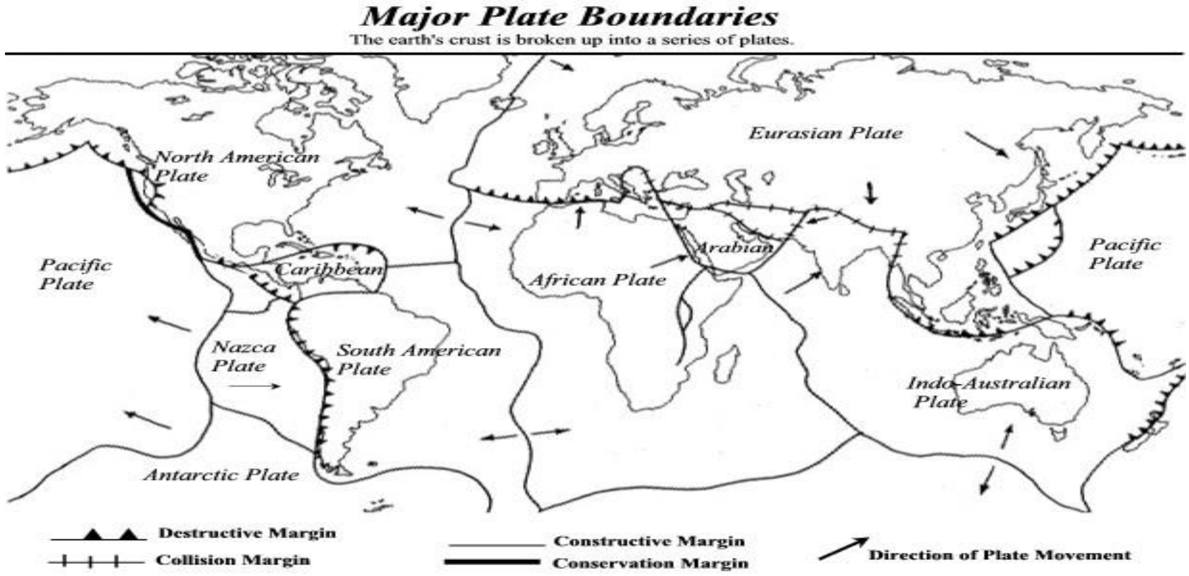
Conservative Plate Boundaries:

E.g. North American and Pacific Plate - The San Andreas Fault.

- Two plates sliding past each other horizontally at a Transform Fault.
- Two plates moving laterally past each other - crust is neither created nor destroyed.
- The movement is not a smooth one and friction builds up, resulting in a 'stick-slip' process with the build up of pressure and friction being released in the form of earthquakes.



- The earthquakes experienced are **shallow-focus earthquakes** - where the pressure is released easily, frequent, low magnitude tremours are experienced. However, more violent, high magnitude earthquakes may result after the a significant build up of pressure is suddenly released.



Fold Mountains

Fold Mountains- Upland areas formed by the Buckling of the earth's crust

- They are found on destructive plate boundaries.

Formation of Fold Mountains:

- When Tectonic plates collide, the sedimentary rocks that have built up between them are folded.
- They are then forced upwards to form Fold Mountains.

Characteristics of Fold Mountain areas:

- Fold Mountain areas have very high mountains with very steep slopes. (e.g. The Matterhorn)
- At the highest/Coldest point, there is usually lots of snow.
- Many Glaciers are formed by erosion.
- Sometimes, lakes are found in the valleys between the mountains. (e.g. Lake Geneva)

Fold Mountain Case Study: The Alps, Central Europe

- The Alps is a Fold Mountain area that stretches across seven Countries in Central Europe.
- Formed about 30 million years ago by the collision between the African and European plates.
- Around 12 million people occupy the Alps.

How are the Alps used?

- **Farming**: The steep upland areas are used for pastoral farming to graze goats e.c.t. and the sunnier south facing slopes have been terraced to plant vineyards. E.g. Lavaux, Spain
- **Hydro-Electric Power:** the narrow valleys are dammed to generate HEP. Switzerland receives 60 % of its power from HEP which is used in both housing and businesses.
- **Mining:** Sodium Chloride, Gold and silver are mined in the Alps, but in recent years mining has declined dramatically due to cheaper foreign sources.
- **Forestry:** Scots pine is planted all over the Alps because it is more resilient to the harsh winters. The trees are logged and sold to produce furniture.
- **Tourism:** - 100 million tourists visit the Alps each year making tourism a huge Source of its income.
  - 70% of tourists visit the Alps for the steep snow covered mountains for recreational activities such as skiing and snowboarding. In the summer tourists come for Walking and climbing.
  - Some villages have been built especially to cater for the vast amount of tourists. (e.g. Tignes, France)
  - However, manmade eyesores like chair lifts have ruined the natural beauty of these areas.

How have the people living in the Alps adapted to the conditions?

- **Steep Relief:**
  - Goats are farmed on steep slopes as they are adapted for that environment.
  - Trees and man-made defences are used to protect against Avalanches and Landslides.
- **Poor Soils:**
  - Animals are grazed in the upper-most areas as the soil is thin and un-fertile, which means crops can't be grown very well.

- **Limited Communications:**
  - Roads have been built over passes (lower points between mountains), e.g. The Mont Blanc Tunnel
  - It takes a long time to drive over passes as they can sometimes be blocked by snow.
  - Tunnels have been cut through mountains to provide fast transport links to residents.

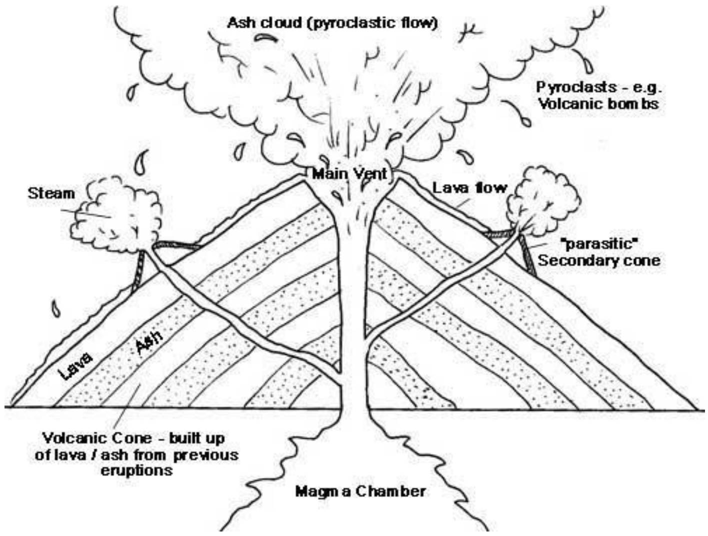
Types of Volcanoes and Super Volcanoes

Volcano- a cone-shaped mountain created by lava form repeated eruptions.

Global Distribution of Volcanoes:

- Volcanoes are found along constructive and destructive plate margins.
- Some are found away from plate margins e.g. Hawaii
- A large majority of volcanoes are found on the ring of fire.
- 20 % of Volcanoes are found at constructive boundaries because magma rises up into the gap created by the plates moving apart, forming a volcano.
- 80 % of Volcanoes are found at destructive boundaries because this is where two plates converge and one plate is subducted under the other. Magma is formed by re-melted oceanic crust during subduction and partial melting of the asthenosphere. Magma rises up (less dense) and may also melt some of the continental crust, giving rise to andesitic magma. It reaches the surface in an explosive eruption.

Volcanic Structure



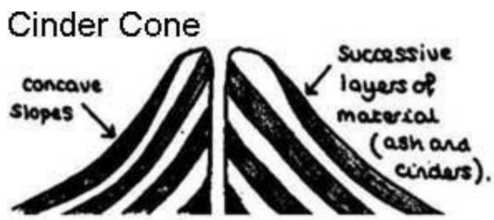
Types of Volcano

- There are **THREE** main types of Volcano:

Composite Volcanoes (Cone Volcanoes)
E.g. Mount Vesuvius

Characteristics:

- They have a steep-sided symmetrical cone shape.
- High with narrow base.
- Alternate layers of acid lava and ash.
- The lava is usually very thick and slow flowing.
- Eruptions are usually very explosive because gas builds up under pressure and then is released very suddenly with great force.
- Less Frequent and Violent eruptions e.g. Mount Vesuvius (79 AD)



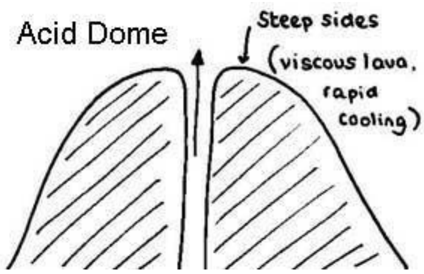
Shield Volcanoes
E.g. Mauna Loa,Hawaii

Characteristics:

- They have a wide base with gentle slopes.
- Made up of hardened lava.
- The lava is more runny so it flows quicker. This runny lava spreads quickly over a wide area, forming a low, flat volcano.
- Frequent and non-violent eruptions.

Dome Volcanoes
E.g. Mount Pelee, Caribbean

Characteristics:



- Made up of layers of hardened lava.
- The lava is thick and slow flowing.
- Lava hardens quickly so they have steep convex slopes.
- narrow base and high cones

Pyroclastic Flow

- A Pyroclastic Flow is a fast moving current of superheated gas and rock.
- It can reach up to speeds of 450 mph and 1,000°C.
- The flows normally travel downhill. The steeper the gradient, the faster the flow.
- The flow is the result of the plume of the volcano losing pressure and collapsing.

How do Scientists Predict Volcanic eruptions?

Millions of people live in areas vulnerable to volcanic eruptions. With so many lives at risk it is important that scientists try and predict volcanoes to try and evacuate as many people as possible from the area. Scientists monitor Volcanoes by checking for signs:

- Monitoring Seismic activity using Seismometers- Sometimes big eruptions can start with small tremors.
- Escaping gases can be monitored using ultra violet detectors.
- Scientists look out for changes in the shape of the volcano (bulges in the mountain where magma builds up beneath it).

Volcano Case Study: Montserrat, Soufriere Hills

- Erupted on 25th June 1997 (small eruptions started in 1995)
- 4.5 million metres cubed of rocks and gases released.
- 19 people killed.

Causes

- Montserrat is above a Destructive plate margin, where the Atlantic plate is being forced under the Caribbean plate.
- Magma rose up through weak points under the Soufriere hills forming and underground pool of magma.
- The Rock above the pool collapsed, opening a vent and causing a large eruption.

Primary impacts

- Large areas were covered with volcanic material and the capital, Plymouth was buried under 12m of ash.
- Over 20 villages on the island were destroyed by pyroclastic flows.
- Schools, hospitals and the island's airport were destroyed.
- Vegetation and farmland were destroyed.
- 19 People died
- 7 people were injured

Secondary impacts

- Fires destroyed many buildings including local government offices and the town's central petrol station which led to further fires.
- Tourists stayed away and businesses were destroyed which disrupted the economy.
- Volcanic ash from the eruption has improved soil fertility.
- Tourism on the island has decreased in recent years as people fear of another eruption.

Immediate Responses

- People were evacuated from the south to the safer areas in the north.
- Shelters were built to house the evacuees.
- Temporary infrastructure was also built, e.g. road supplies.
- The UK provided £17 million of emergency aid to the island.
- Local emergency services provided support units to search for and rescue survivors.

Long-term Responses

- A risk map was drawn up which displayed the southern half of the island out of bounds during the next couple of years.
- The UK provided further financial support (£41 million) to develop the north part of the island and build a new airport.
- Shortly after this big eruption, The Montserrat Volcano observatory was set up to try and predict future eruptions.

Super Volcanoes
(Measure 8 on the VEI)

Characteristics of Super Volcanoes:

Super volcanoes cover a larger area than Volcanoes e.g. Yellowstone: 50 Km wide.

Super volcanoes are much bigger but much flatter than Volcanoes.

Super Volcanoes do not have a crater, but instead they have a caldera.

Ash from a super volcano eruption will settle over hundreds of square kilometres.

Yellowstone, USA (A Super volcano?)

Formation of Super volcanoes at hotspots:

Magma rises through the crust, creating a magma basin below the surface.

This causes a bulge on the surface.

This bulge eventually cracks and lava erupts through vents.

As the magma basin empties the bulge it is no longer supported and it collapses, causing more lava to erupt.

Potential Impacts of a Super volcano eruption:

Exam Question: Describe & Explain the Potential Global impacts of a Super volcanic eruption. (6 Marks)

Sample Answer:

If a super volcano, such as Yellowstone, USA, whose eruption is 40,000 years overdue, were to erupt, the volcano would throw out thousands of metres cubed of rock, ash and lava which would completely destroy anything within a 500 miles radius, Farms and Cities alike. The Magma spewed out from the Caldera would be hurled 30 miles up into the Earth's atmosphere, causing the blotting of sun light. This would consequently cause the global average temperature to drop by 20 degrees, which would result in a "Mini Ice age" and a cold, volcanic winter that would last for several years. During this period, 75% of the entire World's plant Species would die off, which would cause mass Famine and consequent inflation and the very survival of human civilisation across the planet would be threatened.

(For more information on the impacts of a super eruption why not watch the 2005 film "Super volcano".)

Earthquakes & their effects: LEDC's VS MEDC's

- Almost all earthquakes are found along plate boundaries but some (very few) occur in the middle of plates.

How are earthquakes caused at destructive plate margins?

- Tension builds up as one plate gets stuck as its moving down past the other into the mantle.
- The Plates eventually jerk past each other, sending out shockwaves.

Focus- the intrusive point where the earthquake starts.
Epicentre- the extrusive point (on surface) where the earthquake starts.
Shockwaves- Vibrations emitted from Tectonic collisions.

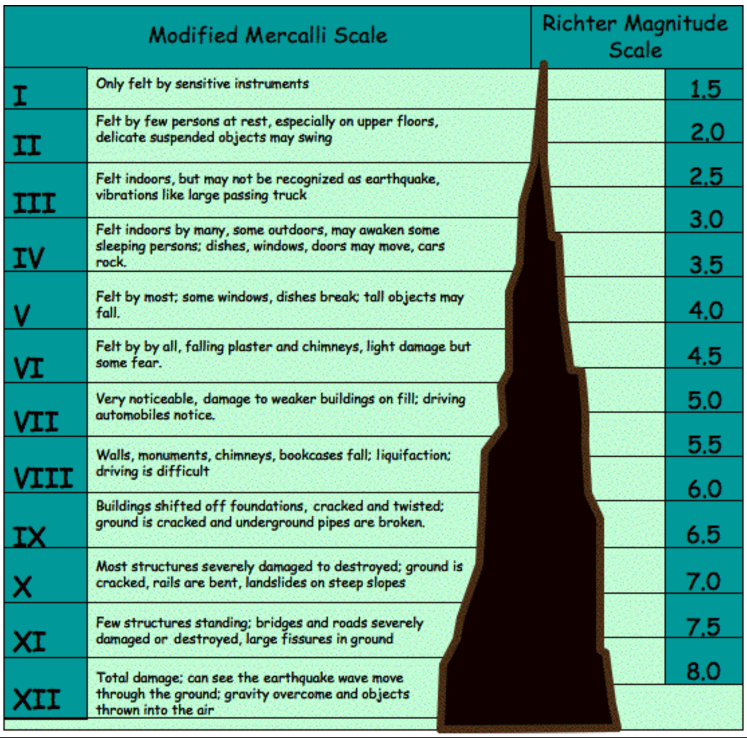
Measuring earthquakes

- Scientists use two universal scales to measure Tectonic Movement (earthquakes):

1. The Richter Scale

- The Richter scale measures the amount of energy released by an earthquake.

- It is measured by using a Seismometer (Measures



Seismic waves).

2. The Mercalli Scale

- The Mercalli scale is a scale which is measured by asking eyewitnesses for observations of what has happened.
- This is less commonly used as different people have different criteria when it comes to assessing damage after a disaster.

Comparing Effects of an Earthquake in a MEDC with a LEDC

MEDC Case Study: Kobe, Japan

- 17th January 1995, lasting 20 seconds
- 7.2 on the Richter Scale
- Roughly 5000 lives were lost

Causes

- Three crustal plates meet near to the coast of Japan. Close to Kobe, the denser oceanic **Philippines Plate** is disappearing beneath the lighter continental **Eurasian Plate**. The Japanese islands have been formed from the **molten magma** released by the melting Philippines Plate. Earthquakes are quite common here and happen because of the friction resulting from the two plates colliding along this **destructive margin.**
- One of the reasons why the effects of the earthquake was severe is because there was a very shallow focus of only 16 km and the epicentre was very close to the settlement.

Primary effects

- Nearly 200,000 buildings collapsed.
- The ground had moved 18cm horizontally and 12 cm vertically.
- 130 km of the "Bullet train" route was destroyed.
- 120 of 150 quays in the port of Kobe were destroyed.

Secondary effects

- Electricity, gas and water supplies were disrupted.
- Roads were at gridlock, delaying ambulances and fire services.
- Fires, caused by broken gas pipes destroyed a further 7,500 houses.
- An estimated 230,000 people were made homeless.
- Industries such as Panasonic were forced to close.

Immediate Responses

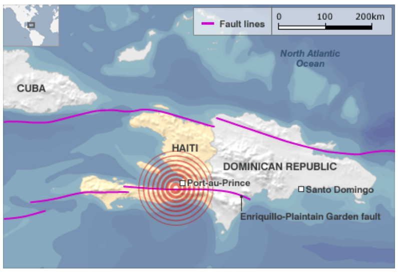
- The Japanese government evacuated people into temporary shelters because they were still at risk from many fires and unstable buildings.
- Bulldozers were brought in to clear fallen buildings.

Long-term Responses

- By July, Kobe's infrastructure (Electricity, Gas, Telephone services) were fully operational.
- The city was re-zoned with more open space and wider roads.
- The Japanese government built homes according to strict building regulations to make sure that the new houses were safe. These regulations were also applied to buildings. Buildings were to be built with flexible frames and fire resistant materials and were only to be built on solid ground.

The Japanese Government was heavily criticised for its response to the earthquake. Relief efforts were condemned for being slow, uncoordinated and badly equipped.

LEDC Case Study: Haiti Earthquake



- 12th January 2010 (Worst in 200 years)
- 7.0 on the Richter Scale
- Roughly 230,000 lives were lost.

Causes

- Haiti lies close to the boundaries of two tectonic plates. The Caribbean and the North American plates.
- Shallow focus of 13 km below the earth's surface.
- Seismologists had warned of a huge earthquake as this fault had been "locked" for 250 years. They predicted that there would be a huge release of stress that had been building up for centuries.

Primary effects

- 280,000 buildings had collapsed.
- This accounted for 90 % of all the countries buildings.
- 16,500 Schools were damaged or completely destroyed.
- Three main universities were also severely damaged.

- Severe famine caused by food shortages.

Secondary effects

- Roads were blocked for 10 days after the quake.
- The international airport was made unusable due to control tower damage.
- The main prison was wrecked and 40,000 of the inmates escaped.
- Two months after the quake, the rainy season began which caused disease and mudslides.
- The public telephone system was knocked out, with no signal for mobile phones and internet.

Immediate Responses

- By 16th January, US helicopters were beggining to distribute aid to remote places.
- In the North of Haiti, mass graves were built and tens of thousands of bodies were brought by dumper trucks.
- Many countries responded to appeals for aid, pledging funds and dispatching rescue and medical teams, engineers and support personnel.
- There was much confusion over who was in charge, air traffic congestion, and problems with prioritization of flights further complicated early relief work.

Long-Term Responses

- The EU gave $330 million and the World Bank waived the countries debt repayments for 5 years.
- The Senegalese offered land in Senegal to any Haitians who wanted it.
- Between 23 major charities, $1.1 billion had been collected for Haiti for relief efforts, but only two percent of the money had been released.
- One year after the earthquake 1 million people still remained displaced.

Tsunamis: Causes, effects and responses

Tsunami- A long high sea wave caused by an earthquake or other disturbance.

Tsunami Case Study: Indian Ocean, 2004

- 26th December 2004
- 9.1 on the Richter scale
- Roughly 230,000 people were killed

Causes:

- Along the west coast of Indonesia lies a destructive plate margin.
- On 26th December 2004, there was an earthquake off the west coast of Sumatra, measuring 9.1 on the Richter scale.
- The plate that moved into the mantle cracked and moved very suddenly, which caused a tsunami with waves up to 30m high.

This tsunami affected most countries bordering the Indian ocean e.g. Indonesia, Thailand, India & Malaysia

Primary effects:

- Roughly 230,000 people were killed by the Tsunami.
- Whole settlements were destroyed and over 1.7 million houses were destroyed.
- The Infrastructure of many countries was severely damaged. E.g. Roads, Water and pipes.

Secondary effects:

- 5-6 million people were left without food and drinking water.
- There was severe damage to the economy. Millions of fishermen lost their jobs and tourism declined as people feared of a similar catastrophe.
- Marine life like Coral reefs and shellfish were destroyed by the sheer force of the wave.

Immediate Responses:

- Within a matter of days hundreds of millions of pounds of pounds had been given to give those affected food, medical attention and care.
- Foreign countries sent ships, planes and teams of specialists to help escort people to safety and begin the long clear up.

Long-term responses:

- Billions of pounds have been given to help re-build the infrastructure in the countries affected.
- Numerous programmes were set up to re-build houses and help people get back to work.
- After this grim warning from nature, a Tsunami warning system had been put in place in the Indian Ocean to try and reduce the effects.
- Disaster management plans have been put in place in some countries so that the locals know what to do in the future to reduce the death toll.

Key Words

Volcano- a cone-shaped mountain created by lava form repeated eruptions. **Tsunami-** A long high sea wave caused by an earthquake or other disturbance. **Fold Mountains**- Upland areas formed by the Buckling of the earth's crust	**Focus**- the intrusive point where the earthquake starts. **Epicentre**- the extrusive point (on surface) where the earthquake starts. **Shockwaves**- Vibrations emitted from Tectonic collisions. **Tectonic Plate-** a huge section of the Earth's crust **Convection Current-** a current caused by movement by **CONVECTION** OF warmer fluid into an area of cooler fluid.

Exam-Style Questions

1. Describe how Continental crust is different from Oceanic crust. (2 Marks)

2. Draw an annotated diagram of a destructive plate margin. (4 Marks)

3. a. At which type of plate margin can Fold Mountains be found? (1 Mark)

   b. Describe how fold Mountains are formed. (2 Marks)

4. Describe the ways in which a fold mountain area you have studied is used. (8 Marks)

5. Describe and explain the global distribution of volcanoes. (4 Marks)

6. Contrast the characteristics of shield volcanoes and composite Volcanoes. (4 Marks)

7. For a volcanic eruption you have studied, describe the cause and the primary and secondary effects. (8 Marks)

8. Suggest three ways that scientists could monitor a volcano to predict when it will erupt. (3 Marks)

9. Briefly describe the formation of Super Volcanoes. (4 Marks)

10. Suggest how super volcanoes differ from Volcanoes. (4 Marks)

11. Explain how earthquakes are caused at conservative Plate margins. (3 Marks)

12. Contrast the Richter scale with the Mercalli scale. (4 Marks)

13. Describe and compare the primary impacts of earthquakes in rich and poor parts of the world that you have studied. (8 Marks)

14. Describe the responses to a Tsunami that you have studied. (8 Marks)