Unit 1: Topic 1b Hazardous Earth—Tectonics

What is the earth's cross section and what are the layers of the earth?

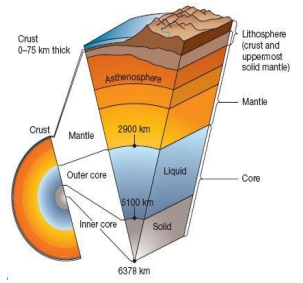
Layer		Physical State	Composition	Temperature (°C)
Crust	Continental	Solid	Granite	1000
	Oceanic (sea)		Basalt	
Mantle	Upper	Solid	Silica-based minerals	1000-4000
	Lower	Liquid		
Core	Outer Core	Liquid	Iron/Nickel	4000-5000+
	Inner Core	Solid		

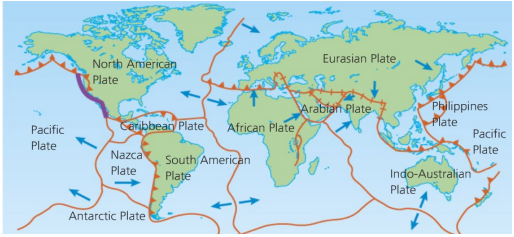
The upper mantle is further divided into 2 layers:
Lithosphere– crust and upper mantle 80-10km thick broken into plates.
Asthenosphere– denser upper mantle 100-300km deep

What are the main crust types?

Continental crust (granitic)
- thicker
- older
- lighter/less dense
- 35 km thick

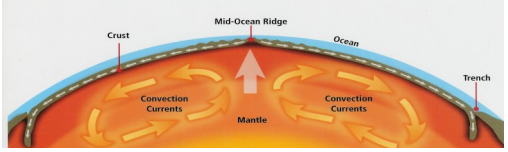
Oceanic crust (basaltic)
- thin
- younger
- heavier/more dense
- 6-8km thick





How do the earths tectonic plates move?

1. Residual heat and radioactive decay in the core generates heat which passes through the molten liquid rock in the mantle in circular currents.
2. As it heats up and becomes less dense it rises then as it cools and hits the lithosphere it spreads out and sinks towards the core (like a lava lamp).
3. These circular movements or **CONVECTION CURRENTS** causes the crust (plates) to collide, slide or be pulled apart leading to earthquakes and volcanoes.



What are the different types of plate boundary?

Divergent

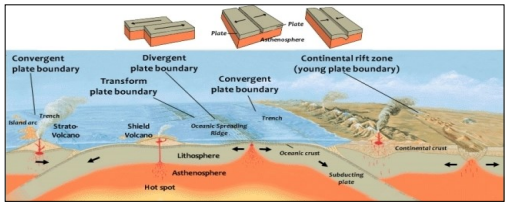
Rising magma in opposite directions moves plates apart leaving cracks allowing magma from the mantle to fill the gap, erupts onto the surface and cools as new land or a shield volcano. E.g. Mid-Atlantic Ridge. Earthquakes can also occur as the plates don't always move apart smoothly.

Convergent

Rising magma in the same direction causes plates to converge. The denser oceanic plate sinks beneath the less dense, granitic continental plate (subduction) creating a deep oceanic trench. The oceanic plate sinks into the mantle and melts creating composite volcanoes E.g. Nazca plate and South American plate. Sudden movements can cause earthquakes or when two plates of equal density collide fold mountains are formed.

Conservative

Rising magma causes plates to slide past each other or in the same direction as each other. No crust is destroyed or created. Earthquakes occur along these faults when pressure builds along the boundary although volcanoes do not form here. E.g. San Andreas Fault, USA.



What are the different types of hazards and their causes?

Volcanoes mainly occur in lines along plate margins. Volcanic eruptions are (measured on the Volcanic Explosivity Index V**EI)** can cause **earthquakes**. **Earthquakes** can occur on conservative plate margins. The point below the surface is called the **FOCUS**, the point on the ground above the **FOCUS** is called the **EPICENTRE**. Destructive margins account for 90% of the World's earthquakes. Some **volcanoes** occur away from plate margins at **hotspots** and some **earthquakes** occur miles from plate margins. **Tsunamis** are destructive oceanic waves caused by under sea earthquakes and volcanic eruptions creating waves that can travel up to 900km/h.

What are the different types of Volcano and what are their features?

Volcanoes vary in shape and size. They are formed where molten rock from the magma chamber erupts onto the surface through a vent. Molten rock is called magma below the surface but when it erupts on to the surface it becomes lava. As well as lava volcanoes throw out ash, cinders, pumice, dust gases and steam from its crater. They are classified depending on what type of plate boundary they occur on:

	Shield (divergent)	Composite (convergent)	Hotspots (divergent)
Shape	Low, flat, gentle slopes	Steep sided, layers of ash and lava	Low, flat, gentle slopes
Magma/ lava type	Basaltic magma, fluid, flows very quickly	Granitic/andesitic magma. Viscous, flows slowly, hardens quickly	Basaltic magma, fluid, flows very quickly
Eruption	Frequent, gentle eruptions.	Infrequent, explosive	Frequent, gentle eruptions.
Example	Kilauea, Hawaii	Montserrat, Caribbean	Mauna Loa, Hawaii

What are the impacts of and responses to tectonic hazards?

Primary effects are the immediate effect on people and property e.g. death from collapsed building.
Secondary effects are the impacts on people and property after the event has finished e.g. fires, disease.

	Volcanic eruption— Emerging Country, Philippines
Facts	- Mount Pinatubo 1991 - dormant for 600 years - Eurasion plate subducting below Philippine plate
Primary impacts	- 847 deaths - 5000 homes destroyed, 70000 damaged - power supplies cut off, roads and bridges were unstable
Secondary Impacts	- Hundreds died from disease e.g. diarrhoea - Rice crops destroyed costing famers approx £20 million - Economy (farming, fishing and tourism) decimated - very high levels of unemployment
Responses	Prediction: scientist detected moving magma - tiltmeters were installed to monitor the shape of the surface as the magma rose - helicopters flew over the crater daily to monitor gases - geologist mapped recent eruptions to decide on areas to be evacuated - Warnings were issued, locals were evacuated, vaccinations were given and aid was flown in Long term responses: - dykes and dams were built to protect against flooding and lahars - new farms were set up away from the danger area - converting the former US air base into the Clark International airport where businesses employ 47000 people.

	Volcanic eruption— Developed Country, Hawaii, USA
Facts	- Kilauea since 1983 - one of the most active volcanoes in the world - formed over an oceanic hotspot
Primary impacts	- 100km^2 land destroyed - over 200 homes destroyed, roads blocked, utilities damaged - Steam endangers lives
Secondary Impacts	- constant air pollution and acid rain from 2000 tonnes of sulphur dioxide per day affecting crops, cars, water supplies - On-going problems of respiratory disease from 'VOG' - Positive impacts of 2.6million tourist to volcano national parks. - Lava produces fertile soil generating US$30 million per year
Responses	- Not generally a threat to human life. —HVO monitors the volcano regularly —17 web cams monitor the activity - gas emissions are monitored and seismometers detect

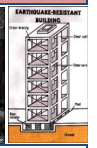
Why do most earthquakes occur at convergent plate boundaries?

Earthquakes occur along plate boundaries and are a sudden movement of the earths crust. Over 90% occur at convergent boundaries where stresses build up in the subduction zone until eventually the rock fractures along a fault and the energy is released as a n earthquake. The point where the energy if released is called the focus and the point on the earths surface directly above this point where most force is felt is called the epicentre. Earthquakes also occur on conservative boundaries and smaller ones on divergent boundaries. The impact earthquakes have is dependent on a number of factors including the depth of the focus, the population density, the time of day/week, the degree of preparation and vulnerability.

How are earthquakes measured?

Earthquakes are recorded using seismometers and the magnitude is then given according to the Richter scale with a value of 1-10 (logarithmic Scale).

	Earthquake—Developing country Port-au-Prince, Haiti
Facts	- January 2010, - epicentre 10 miles from Port-au-Prince - 7.0 on the Richter scale - 316,000 people died
Primary impacts	- Shanty towns crumbled)250,000 houses) - 30,000 businesses buildings collapsed - port and major roads were damaged
Secondary impacts	- 2011 people still lived in temporary homes. - Est. 1 in 5 jobs were lost. - Damaged air, land and sea transport - Looting and violence - relief camps had no electricity, running water, or sewage disposal
Responses	- rescue and medical teams were sent. - EU gave $330 million - World Bank waived debt repayments for 5 years. - 23 major charities collected $1.1 billion - Dominican Republic which neighbours Haiti offered support. - USA took control of aid efforts



Effects	Earthquake—Developed country, Kobe, Japan
Facts	- January 1995 at 5.46am - 6.9 on the Richter scale, - 10 million people lived in this area.
Primary Impacts	- 5000 died - 102,000+ buildings destroyed - motorways collapsed, roads closed by fallen debris from buildings
Secondary Impacts	- Est. cost to rebuild the basics = £100 billion. - 300,000 homeless - wooden buildings burnt down in fires caused by broken gas and electricity lines - no power for heating, lights, cooking, etc. - Clean, fresh water was in short supply
Responses	International aid was rejected the city recovered due to government money. - Water, electricity and gas etc were fully working by July - New laws making buildings and transport structures more earthquake proof - instruments installed in the area to monitor earth movements. - Schools and factories have earthquake drills.