Paper 1: Living with the Physical Environment
Section A: Natural and Tectonic Hazards

What is the definition of a Natural Hazard?

A natural hazard is a natural event such as an earthquake, volcanic eruption, tropical storm or flood that poses risk of death, injury or damage to people and property.

What is the types of Natural Hazard?

Geological Hazards – these are caused by land and tectonic processes.	**Atmospheric Hazards** – these are caused by changes in weather and climate.
Earthquakes, volcanic eruptions, landslides, avalanches, mudflows and tsunamis.	**Tropical storms, hurricanes, tornadoes, rain, drought and flooding.**

What is Hazard Risk?

Hazard risk is the chance or probability of being affected by a natural event.
People who live close to a river may be at risk to flooding. People who live near on a volcano may be at risk to an eruption.
People chose to put themselves at risk after weighing up the advantages and disadvantages and because such events don't happen very often, they decide to accept the risk. Some people may have little choice of where to live or knowledge that where they are living is dangerous.

What factors affect Hazard Risk?

Urbanisation – Over 50% of world's population now live in cities. For examples Toyko and Los Angeles are at risk from earthquakes.
Poverty – In poorer parts of the world poverty may force people to live at risk. For example, in Caracas, Venezuela, a shortage of housing had led to people building on unstable slopes prone to floods and landslides.
Farming – When a river floods it deposits fertile silt on floodplains like that of the River Ganges in Bangladesh. The land is great for farming. When people live there they put themselves at risk to flooding.
Climate Change – In a warmer world the atmosphere will have more energy leading to more intense storms and hurricanes. Climate change may lead to some parts of the world becoming wetter and prone to flooding and other parts drier and prone to drought.

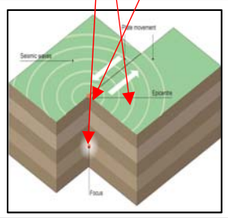
What is the Plate Tectonic Theory?

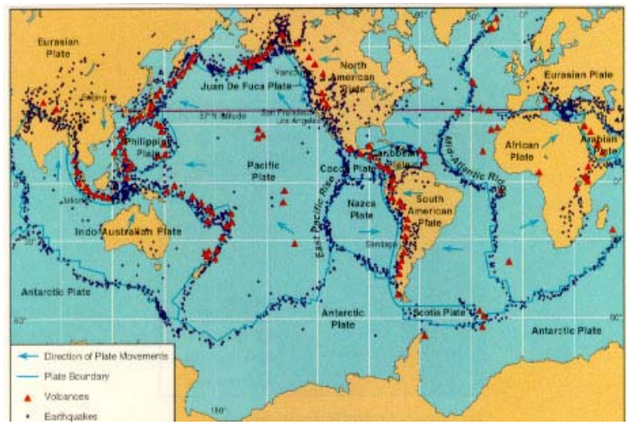
The Earth's crust is split into many plates about 100km thick. There are two types of crust – dense thin oceanic crust and less dense, thick continental crust. Plates move in relation to each other due to convection currents in the mantle. This is where the core heats molten rock in the lower mantle, causing it to become less dense and rise to the upper mantle, where it cools, becomes denser and sinks back down to the lower mantle creating a circular motion (convection current). This movement causes the plates to move which creates tectonic activity leading to earthquakes and volcanoes.

What is the global distribution of Earthquakes and Volcanoes?

An earthquake is a sudden violent period of ground shaking within the Earth's crust. Earthquakes are caused when two plates become locked causing friction to build up. From this stress, the pressure will eventually be released, triggering the plates to move into a new position. This movement causes energy in the form of seismic waves, to travel from the focus towards the epicentre. As a result, the crust vibrates triggering an earthquake.
Earthquakes occur at all plate margins, for example along the western coast of North and South America. The occurrence of earthquakes around the edge of the Pacific Ocean follows the plate boundaries. Some earthquakes do not occur at plate margins and are caused by human activity such as underground mining and extraction.
A volcano is a large and often conical-shaped landform usually formed over a long period of time by a series of eruptions. Like earthquakes, most volcanoes occur in long belts that follow plate margins, for example around the edge of the Pacific Ocean. This is known as the 'Pacific Ring of Fire'. There is also a belt of volcanoes through the middle of the Atlantic Ocean. This is the Mid-Atlantic Ridge which includes the Azores and Iceland which are volcanic islands. Volcanoes are fed by hot molten rock (magma) from deep within the Earth. This rises to the surface at constructive and destructive plate margins. Volcanoes also form at hot spots, where the crust is so thin that magma can pierce and break through to the surface. The Hawaiian Islands in the Pacific Ocean are a good example of a hot spot volcano.

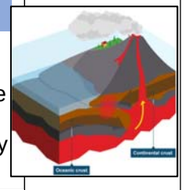
The point directly above the focus where the seismic waves reach first, is called the epicentre. Seismic waves travel out from the focus, which is the point at which pressure is released.





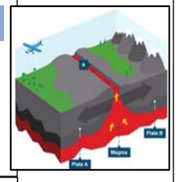
What are the processes at Destructive Plate Margins?

This is where two plates are moving towards each other. The oceanic dense plate subducts beneath the less dense continental plate. Friction between the plates causes earthquakes. As the oceanic plate moves downwards it melts. The magma here is very viscous (like jam) and forces its way to the surface to form steep sided composite volcanoes such as those found on the west coast of South America where the Nazca plate subducts beneath the South American plate. Eruptions are often very violent and explosive.



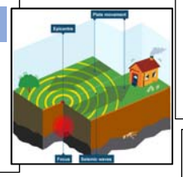
What are the processes at Constructive Plate Margins?

This is where two plates are moving apart like what is happening at the Mid-Atlantic Ridge where magma forces its way to the surface along the Mid-Atlantic Ridge. As it breaks through the overlying crust it causes earthquakes. On reaching the surface it forms volcanoes such as Eyjafjallajokull in Iceland. The magma here is very hot and fluid, it will flow a long way before cooling, resulting in typically broad and flat shield volcanoes.



What are the processes at Conservative Plate Margins?

This is where two plates are sliding alongside each other such as the San Andreas Fault in California. The faster-moving Pacific Plate is sliding in the same direction next to the slower North-America Plate. Friction between the two plates then causes earthquakes as stresses gradually build up over many years, they are released suddenly when pressure builds up and plates slip or shift. There are no volcanoes here.



How can we manage and reduce the effects of a Tectonic Hazard?

Monitoring and Prediction	Protection	Planning
Seismometers are used to measure tremors before a main earthquake. Monitoring the water table (water tends to fuctuate before an earthquake). Satelitte monitor ground deformation.	Designing buildings and roads to withstand earthquakes. Increasing awareness.	Earthquake drills. Seismic maps can be made. Prepare emergency supplies.

What are the effects of, and responses to Tectonic Hazards?

Primary effects are caused by the ground shaking, and can include deaths, injuries and damage to roads and buildings. **Secondary effects** are the result of primary effects and include tsunami, homelessness, fires and landslides.

Christchurch Earthquake (HIC) 22nd February 2011- Magnitude 6.3		Haiti Earthquake (LIC) 12th January 2010- Magnitude 7	
Primary Effects	**Secondary Effects**	**Primary Effects**	**Secondary Effects**
185 people died 2000 people seriously injured Liquefaction – underground water came to the soil and caused buildings to sink. 50% of central buildings damages inc catherdral Glacier broke	80% of city without electricity Business out of action Schools had to share classrooms Damage to roads People mentally affected Christchurch could no longer host the Rugby World Cup so lost the benefits e.g. tourism and income	316,000 people killed and 1 million homeless. 250,000 homes and 30,000 other buildings were destroyed or damaged. Transport links, Hospitals and schools damaged. Prison destroyed inmates escaped	1 in 5 people lost their jobs. Hospitals and morgues became full and bodies piled up on the streets. Diseases such as cholera became a problem. Difficult to get aid because of transport issues. Poor sanitation Looting
Immediate Responses	**Long-term Responses**	**Immediate Responses**	**Long-term Responses**
Cared for vulnerable people and ensured people were safe Chemical toilets provided for 30,000 Areas were zoned to classify damage International Aid	Paid $898 million in building claims Temporary housing Water and sewerage was restored by August Road and houses were cleared of silt from liquefaction. 80% road and 50% of footpaths were repaired.	$100 million in aid by USA $330 million in aid from EU 810,000 people in aid camps 115,000 tents provided Healthcare supplies Rescue each other 4.3 million provided with food rations	98% of the rubble on the roads still needed clearing. 1 million without houses after a year. Special cash/food for work projects. Temporary schools Water and sanitation supplied for 1.7 million people

What are the reasons why people continue to live in areas at risk from a Tectonic Hazard?

People living in poverty ridden areas have more important things to think about like food, money, security and family.
Plate margins often coincide with very favourable areas for settlement, such as coastal areas where ports have developed.
Fault lines associated with earthquakes allow water supplies to reach the surface. This is important in dry desert regions.
Better building design can withstand earthquakes so people feel less at risk.
Volcanoes can bring benefits such as fertile soils, rocks for building, rich mineral deposits, hot water and geothermal energy.
More effective monitoring of volcanoes and tsunamis waves enable people to receive warnings and evacuate before events happen.