

**Drayton Manor High School**

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| Exam Question |
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| (a) | Study Figure 1. Analyse the pattern of the depth of earthquake hypocentres shown on the map. *(4 marks)* |

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| (b) | Assess the factors that influence the management of the impacts of earthquake in countries at different levels of development. *(12 marks)* |

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| **Total:** 16 marks |

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| Source |
| **Figure 1: Different depth tectonic earthquake boundaries mapped on to a world map** |

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| Mark scheme |
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| (a) | 4 marks (AO3 = 4 marks)The key points you need to pick out from the map include: • Some plate boundaries consist of mostly shallower hypocentres, such as the Mid-Atlantic Ridge. • Some have shallower and deeper hypocentres, such as the Pacific coast of South America. • The deepest hypocentres are to the west of the Pacific, at East Asia and New Zealand.**Hints and tips**Systematically break down the elements of the map to draw out the patterns across the globe. |

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| (b) | 12 marks (AO1 = 3 marks, AO2 = 9 marks)Some suggested ideas are given below but you may wish to expand on these or include other relevant points.**AO1 Demonstrating your knowledge and understanding**There are three main categories of response, each requiring increasing amounts of technology to achieve their goals. • Modifying the loss, e.g. through aid following a disaster. • Modifying the vulnerability, e.g. through prediction/warning, community preparedness. • Modifying the event, e.g. coastal defences against tsunamis, making buildings ‘life safe’.**AO2 Applying your knowledge and understanding** • By making relevant connections. • Supporting your evaluation with evidence. • Producing a balanced and coherent argument.There are various ways in which you can modify loss (aid, insurance, etc.), vulnerability (prediction and warning, community preparedness and education) and the event itself (life-safe buildings, engineering defences such as tsunami walls). You could discuss these through the use of contrasting examples, making direct and clear connections between them to allow you to apply the three factors above to produce a balanced argument.**Answers to this question will be given a mark within a level bandLevel 1 (1–4 marks):** You show only a limited geographical knowledge and understanding of the factors affecting the management of the impacts. You make limited connections between aspects of your answer and support your interpretations with limited evidence. You draw unbalanced conclusions based on the material in your answer.**Level 2 (5–8 marks):** You show mostly relevant and accurate geographical knowledge and understanding of the factors affecting the management of the impacts. You make mostly relevant connections between aspects of your answer as appropriate and support your interpretations with some evidence. You draw conclusions based on the material in your answer but your conclusions may be limited or unbalanced.**Level 3 (9–12 marks):** You show relevant and accurate geographical knowledge and understanding of the factors affecting the management of the impacts. You make sound connections between aspects of your answer as appropriate and support your interpretations logically with evidence. You draw balanced and logical conclusions based on the material in your answer.**Hints and tips**Consider the various factors that can affect the impacts, coming to an overall assessment at the end of your essay.  |

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| Student Response A |
| (a) | Some plate margins have mostly shallower hypocentres, others have shallow and deeper hypocentres. For example, margins with hypocentre depths of between 0 and 33 km are found in places such as the Mid Atlantic, Europe and the Indian Ocean. The locations that have deeper hypocentres (34–400 km) are found in the Pacific Ring of Fire, surrounding the Pacific Ocean, including off the coast of South America. The deepest hypocentres of between 401 and 700 km are found off the eastern coast of Asia.

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| **Examiner comment**The student states the overall pattern clearly. Thorough analysis is given of the patterns in the map, which is backed up with examples from the source. 4 marks. |

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| (b) | It is possible to classify the factors that affect the management of the impacts of tectonic hazards as follows. First, you can attempt to modify the loss. This includes strategies such as insurance cover against earthquake damage. Seismologists can work with insurance companies to try to calculate premiums based on seismic data such as likely shaking intensity. Policies can also cover against volcanic hazards including ash falls. Second, you can try to modify the vulnerability through strategies working on prediction and warning (including earthquake early warning systems) and community preparedness, including education on how to respond to the onset of a tectonic hazard and the aftermath of the event. Finally, you can try to modify the event. This is done through the use of technology to mitigate the impacts, including designing buildings to be life safe and the use of coastal engineering to defend against tsunamis.

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| **Examiner comment**Thorough knowledge and understanding of the relevant factors shown. |

As you move through those factors, from modification of loss, through vulnerability to the event, more technology is needed. That means that countries at different levels of development would have different capacities to make effective use of these strategies — more developed countries will be able to use a wider range of strategies than those less developed.

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| **Examiner comment**Relevant connections made between the factors. |

We can see this at work through a series of examples. For example, in the 2010 earthquake in Haiti, in the region of 300,000 people lost their lives in this magnitude 7.0 event. In contrast, the Japan earthquake in 2011 saw the loss of nearly 16,000 people — despite the fact that this was a much larger earthquake, measuring magnitude 9.0. The main reason for this was the ability of the Japanese authorities to modify the event. Despite the huge amounts of energy emitted during the earthquake, there was remarkably little structural damage to buildings in Japan. No buildings collapsed in Tokyo. And, although there was some damage to buildings due to liquefaction, only 18,000 of the 125,000 buildings destroyed in the earthquake were destroyed as a result of seismic shaking. This is because Japan has some of the strictest building codes in the world — the codes, known as *shin-taishin* — were introduced in 1981. In contrast, many of the deaths in Haiti were as a result of poor building construction. This was because of a combination of poverty (many of the people did not have the money to add the extra materials that would have helped make the buildings life safe) and lack of building codes implemented by the authorities.In addition, the Japanese authorities were able to modify people’s vulnerability through education and prediction. In total, 185 seismometers in Japan constantly monitor the seismic situation and they have developed an elaborate Earthquake Early Warning (EEW) system. This uses the differences in travel time between the P- and S-Waves to give alerts of an imminent earthquake, giving people a warning of a few vital seconds that would allow them to take action to reduce their vulnerability to the quake (including pulling cars over to the side of the road, and getting under a table if inside a building). This is backed up by extensive education and earthquake drills in the country. In contrast, in Haiti there was a large scale lack of awareness of the nature of the earthquake hazard. Although a team from Purdue University (USA) had been in the country assessing the tectonic risks, and had stated that a magnitude 7 or greater earthquake was overdue, the last major quake prior to 2010 was in 1751. So, the risk of earthquake did not feature highly in people’s thinking — not only the local people, but also the authorities: they did not have any major plans to deal with the aftermath of an earthquake. This left them with only one response: modify the loss. The Haitian government quickly handed over control of dealing with the aftermath to the international community (including the UN) and were very reliant on humanitarian aid to help cope with the 900,000 people left homeless by the quake.

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| **Examiner comment**Good use of evidence to assess the factors in a balanced and coherent argument. |

Overall, then, we can see that countries at a higher level of development can more effectively manage the impacts of earthquakes — through modifying loss, vulnerability and the event itself — than countries at a lower level of development.

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| **Examiner comment**The student shows accurate and relevant knowledge and understanding for AO1. They apply their knowledge and understanding to make relevant connections between development and impacts, supported by evidence and with sound judgements to create balanced and coherent arguments for AO2. Level 3, 11 marks. |

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| Student Response B |
| (a) | The Atlantic Ocean has shallower hypocentres, around 0–33 km deep. The Indian Ocean has hypocentres of this depth also. South America has hypocentres of between 0 and 400 km deep. North America is between 0 and 100 km deep. Asia has some very deep hypocentres, down as far as 700 km deep. Europe has shallower hypocentres — mostly 0–33 km deep.

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| **Examiner comment**Although this answer refers to the source and quotes figures, it is too descriptive. To ‘analyse’ means to draw out the patterns, not simply state what is happening. To improve their mark, the student should look for patterns and relationships in the map. 2 marks. |

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| (b) | When it comes to trying to manage earthquake hazards, there are a number of things that a country can do. For example, you can try to modify the event itself. You do this by using strategies to reduce the impacts such as tsunami walls. You can modify people’s vulnerability by training them in how to respond when an earthquake happens and by making buildings life safe. You can also respond to the earthquake when it happens, for example by providing tents for homeless people.

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| **Examiner comment**Some good knowledge and understanding shown of the relevant factors, but more detail could be given. |

Different countries at different levels of development can do these things to different extents. For example, the Haiti earthquake in 2010. Haiti is a very poor country at a low level of development. When a magnitude 7.0 earthquake struck, many of its building collapsed and up to 300,000 people were killed. This was because the country did not have proper earthquake plans in place beforehand, for example building codes. As a result, many buildings pancaked, killing the people inside. The last major earthquake in Haiti was in 1751, and so most people were largely unaware of the earthquake risk that they faced. Also, it did not have a plan to deal with the aftermath of the earthquake. In fact, it had to give over control of the aftermath management to the United Nations. In contrast, the following year in Japan, a huge magnitude 9.0 earthquake struck, much larger than the one in Haiti. However, only 18,000 people were killed — still a huge number, but far less than Haiti. The Japanese authorities had tried to modify the event by introducing strict building codes — only 14\_f the buildings damaged were due to seismic shaking. They also trained their population on what to do when an earthquake strikes. They also had an earthquake early warning system in place which allowed them to send out warnings after the earthquake happened but before the shock waves arrived to allow people to duck for cover under a table (drop, cover, hold). And in the aftermath, they had a very fast and very extensive response to the damage caused by the tsunami.

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| **Examiner comment**The student shows accurate and generally relevant knowledge and understanding for AO1, although the answer would be improved if more detail were given. The student applies their knowledge and understanding to make some relevant connections between development and impacts, supported by some evidence. Overall, however, more connections could be made for AO2. Level 2, 7 marks. |

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