PAPER 1 - SAMPLE ANSWERS

Question 1 (a) (i)

Calculate the value of R for the data given (3)

Question number	Answer	Mark
1 (a) (i)	**AO3 (4 marks)** Award 1 mark for the sum of d^2 column (Σ) = 118 Award 1 mark for the correct working of equation: $1 - \frac{6 \times 118}{10^3 - 10}$ or $1 - \frac{708}{990} = R$ Award 1 mark for answers that round to R = 0.28 OR Award 1 mark for the correct value of R alone (0.2848).	**(3)**
1 (a) (ii)	Award 1 mark for accept null hypothesis as R value is less than critical value at 0.1 confidence level	**(1)**

Sample A

The formula for Spearman's rank correlation coefficient value R is given below.

D.O.F

$$(R) = 1 - \frac{6\Sigma d^2}{n^3 - n}$$

Calculate the value of R for the data given.

You must show your working.

(3)

$d^2 = 118$

$\Sigma = 24$

$\frac{6 \times 24 \times 118}{10^3 - 10}$ = 0.335

$\hookrightarrow -1$

$= -0.664$

$= 0.7$

degree of freedom = 10 − 1 = 9

R = 0.7

Sample B

$R = 1 - \frac{6\Sigma 118}{n^3 - n}$ $1 - \frac{6\Sigma 118}{20}$

$10^3 - 10$ $\frac{1 - 6\Sigma 118}{20}$

(3)

R = 5.65

Sample C

$R = 1 - \frac{6 \times 118}{10^3 - 10} \Rightarrow$

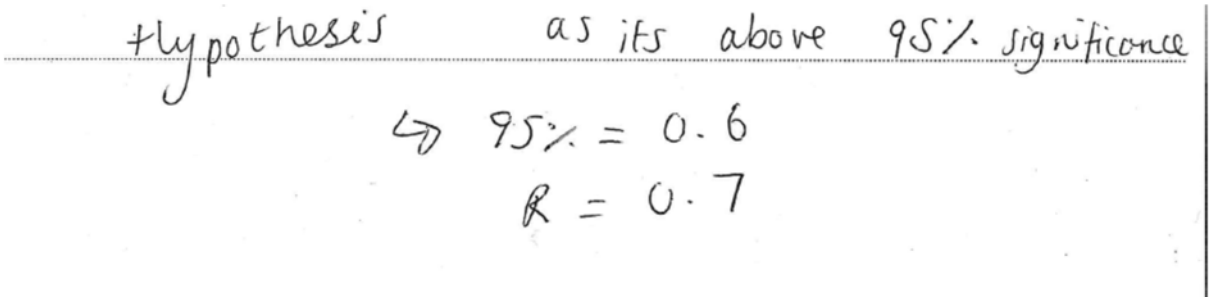
(3)

$R = 1 - \frac{708}{990} = 0.28$

R = 0.28

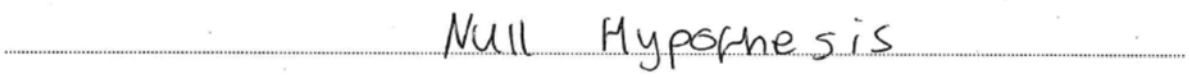
Question 1 (a) (ii) Using the Spearman correlation R value calculated in part (i), state which hypothesis is correct. (1)

Sample A



Sample B

Sample C



Question 1b

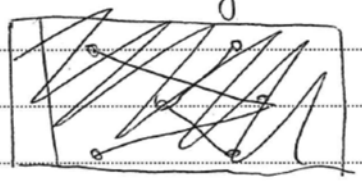
Assess the importance of tectonic hazard profiles in understanding the severity of impacts resulting from earthquake events (12)

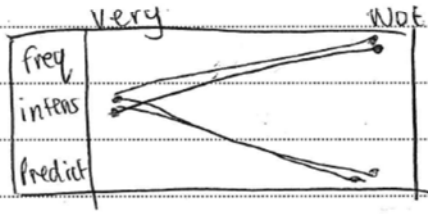
Question number	Indicative content
1(b)	**AO1 (3 marks)/AO2 (9 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Responses that demonstrate **only** AO1 without any AO2 should be awarded marks as follows: - Level 1 AO1 performance: 1 mark - Level 2 AO1 performance: 2 marks - Level 3 AO1 performance: 3 marks. **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • Hazard profiles (magnitude, speed of onset and areal extent, duration, frequency, spatial predictability) are important in understanding hazard impacts. • Hazard impacts are also the result of the interaction of physical factors and the context of the location (Development and Governance). • Geographical factors (population density, isolation and accessibility, degree of urbanisation) influence vulnerability and a community's resilience and so also determine the impacts from hazard events.

Question number	Indicative content
	AO2 • The magnitude of the earthquake event is often seen as the key factor in determining the scale of the impact as even rich countries struggle to cope with mega events such as the 2011 Japanese tsunami. • The frequency of the events are, however, also important as the more frequent the event the more likely there is to be well planned disaster management reducing the impacts as evidenced by the Samoa 2008 tsunami. • It is therefore low frequency, high magnitude extreme events (1 in a 1000-year events) that often cause the largest impacts as prediction is difficult and prevention is impossible such as the Indian Ocean tsunami 2004. • Yet the areal extent can also determine the scale of impacts as earthquakes which are caused by faults with a shallow angle affect a greater area and so cause greater impacts such as in the Afghanistan 2015 earthquake. • Spatial predictability can also be a vital factor as areas with blind faults (such as Kobe 1995) can lead to increased risks due to a lack of understanding of the magnitude of the risk. Areas far from other earthquake belts such as Christchurch (2011) can also have higher than expected impacts due to a lack of spatial predictability. • Other factors such as strong governance can, however, lead to very effective management of immediate disaster recovery, e.g. Sichuan earthquake in China 2008, as well as the development of longer-term education and community preparation such as the education programmes in California. • however, management is expensive and countries with a low level of development cannot afford the levels of investment required to reduce the risks of earthquake events such as in Haiti 2011. • Geographical factors are also a key factor in determining impacts as urban areas with high population densities can have large impacts with relatively small magnitude earthquakes such as in Bam, Iran 2003. • The hazard profile is therefore a key factor in affecting the level of primary risk from an earthquake event but the context of the area and other geographical factors can then significantly amplify or reduce this risk and so also affecting the impacts.

Sample A

Hazard profiles allow you to compare the outcomes of events.
Some benefits are that they are easy to read and understand, and they are also flexible.
They include characteristics such as frequency, predictability and intensity.



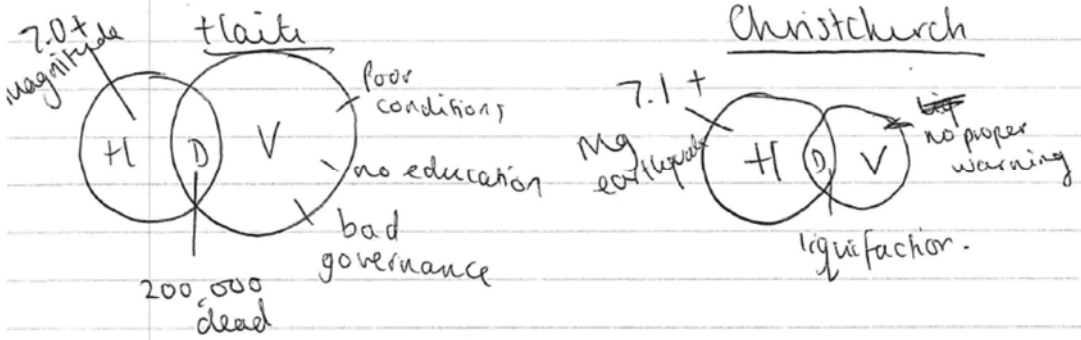


Christchurch VS Haiti

However as shown in the diagram, they're not very accurate as they're ~~subjective opinion~~ subjective. for example on the diagram Haiti & Christchurch are shown to be very similar in terms of the earthquake events but in reality Haiti (2011) a LEDC, had 200,000 + deaths, disease spread, a 7.0+ Mg earthquake and no warning or education on the event Whereas Christchurch - a MEDC, had no deaths, immediate aid, sanitation and could afford to modify vulnerability / hazard whereas Haiti could not. The main problem with the hazard profile is that no human factors are shown, so you can't see vulnerability & the full extent of the disaster.

(Total for Question 1 = 16 marks)

1(b) However, the Degg model in this situation would be better.



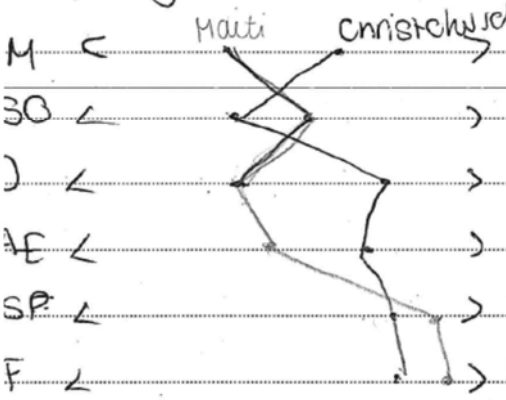
The degg model allows you to see human factors, as well as physical, so it's easier to see what needs altering to reduce the hazard and makes it clear to see the whole severity of impacts. Also figures can be used. However, it also is subjective, and could be hard to interperate.

In conclusion, the hazard profile is important to see physical impacts, but the Degg model is more important for understanding the severity of an event as you can see both physical and human factors which is a more accurate representation.

Sample B

The Tectonic hazard profiles show the magnitude, speed of onset, duration, areal extent, ~~special~~ predictability and frequency of events shown.

These hazard profiles are very effective in quickly displaying and gaining lots of information on a hazard (and comparing hazards together). They, however, are not so effective in displaying the areal picture as they do not show human or vulnerability aspects and don't include a scale or specific data. They are useful in comparing events, for example Haiti and Christchurch.



The severity of impacts are not properly shown through a hazard profile. It focuses on a few key features of the hazard itself such as the frequency and magnitude. However it displays the areal ~~area~~ extent of damage but since there are no data/ figures the severity isn't portrayed. However they are good for comparisons. Overall, hazard profiles are important but not the most effective in understanding the severity of impacts from eq events **(Total for Question 1 = 16 marks)**

Sample C

Hazard profiles are a subjective method of comparing earthquake events, however are also comparitive. ~~The great~~ One criteria is magnitude. However, there is no direct correlation between magnitude and numbers of deaths. Often, it is human factors that influence the severity. For example, Haiti (8.0) and Christchurch (7.9) killed 150,000 and 800 respectively, despite similar magnitudes.

Another is spatial predictability. The technology in predicting Earthquakes is poor. However, the Kobe Earthquake in Japan made use of evacuation alarms, and gave time for residents to get to higher ground. This organisation from governments is not used in poorer countries. Therefore, being able to predict earthquakes can reduce the severity as the death toll is often less.

Speed of onset is not good for comparison of earthquake events, as all earthquakes ~~are~~ develop quickly.

In conclusion, although hazard profiles allow for comparison of key physical factors, human factors play a just as significant, if not more, part in determining earthquake severity. **(Total for Question 1 = 16 marks)**

Question 3 a i

Study Figure 3a which shows a coastal landscape

(a) (i) Explain how erosional processes have contributed to the formation of the features shown. (6)

Question number	Answer
3(a)(i)	**AO1 (3 marks)/AO2 (3 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • The importance of erosion processes (hydraulic action, corrosion, abrasion, attrition) • Erosion creates distinctive coastal landforms (wave cut notches, wave cut platforms, cliffs, and the cave-arch-stack-stump sequence). • Geological structure (jointing, dip, faulting, folding) is an important influence on coastal morphology and also on the formation of cliff profiles and the occurrence of micro-features, e.g. caves. **AO2** • There is clear evidence of a range of features such as a wave cut platform, wave cut notch on the sea stack and a cave which are the result of erosional processes. • The dense joint pattern of the rock (chalk) will enhance the role of hydraulic action and lead to the formation of these features particularly micro features such as the caves. • The clear folding of the rock strata has led to the less than vertical cliff face highlighting that other factors are responsible for the morphology of this coastal landscape.

Sample A

As seen in figure 3a, one can see ~~ex~~ caves. This is formed when a fault, such as a crack appears in a rock. Hydraulic action takes place, where water enters the rock and wears it away forming caves.

Also, a stump is present. When a cave is formed, erosion keeps occuring until it erodes through, creating an arch. eventually, this falls, leaving a stump

Sample B

Erosional processes have affected this emergent coastline. Destructive waves have eroded the beach ~~and~~ due to a strong backwash and weak swash carrying the ~~sediment~~ depositing it away, into the sea. The waves have began to erode the cliff to form a cave by abrasion: the ~~sea~~ rocks are thrown at the ~~sea~~ cliff face causing (pump + grind) it to erode. Corrasion takes place as the sediment/rocks have a sand paper effect, ~~&~~ weaking cracks (fissures), ~~and causing~~ Hydraulic action causes water to trap into these cracks and pressure builds up forcing the cracks to widen and break down, eroding the cliff. Causing the cliff face to break down and ~~a~~ caves to be formed, as well as stacks and stumps from the repeated action of erosion over the years.

Sample C

The wave cut platform has been created from basal erosion by hydraulic action and abrasion. This caused undercutting, leaving a wave cut notch between low and high water marks and an overhang. Due to biological weathering on the cliff roof and gravity, the cliff collapsed and this causes retreat, leaving the platform. The headland has been eroded by marine erosion to form a cave. Erosion at the back of this forms an arch. Eventually, the arch roof collapsed leaving a stack, as shown in figure 3a.

Question 3 a ii

Explain how subaerial processes have contributed to the development of this landscape. (6)

Question number	Answer
3(a)(ii)	**AO1 (3 marks/AO2 (3 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • Subaerial processes of mass movement and weathering influence coastal landforms and contribute to coastal landscapes. • Weathering (mechanical, chemical, biological) and mass movement (blockfall, rotational slumping, landslides) is important on some coasts with weak and/or complex geology. • Geological structure (jointing, dip, faulting, folding) is an important influence on coastal morphology and erosion rates, and also on the formation of cliff profiles and the occurrence of micro-features, e.g. caves. **AO2** • The development of the sea stack has been formed by the weathering and subsequent collapse of an arch, itself created by the erosion and enlargement of a cave • the development of the relatively steep cliff profile has been maintained by weathering of the rock (likely to be a combination of both mechanical and chemical) as well as subsequent mass movement (likely to be blockfall) as evidenced by the dense joint pattern of the rock as well as the evidence of presence of chalk on the beach • The development of the beach itself might be the result of differential recession rates caused by faulting as evidenced in cliff in the foreground highlighting that other factors are responsible for the development of this coastal landscape.

Sample A

Vegetation is present, meaning biological weathering is taking place. The roots of the plant will grow through the rock, slowly breaking it up.
A boulder is seen at the entrance to the cave, indicating mass movement, when the unconsolidated rock is saturated with water, becomes lubricated and heavy, causing rocks to fall.
Lastly chemical weathering such as oxidisation will have caused small fragments of rock to fall.
Mass movement is again present, as a small scree slope is seemingly forming to the left of the cave.

Sample B

Sub-aerial processes such as mass movement, weathering and rock fall have occured. As the surface run off from rainfall, for example, erodes the cliff, rock fall occurs and the rocks collect at the cliff foot. Rotational slumping has occured, o when water runs over permeable rock further weakening it and causing it to slump; the diagonal lines represent this on the cliff face. ? chemical weathering, rainfall, mechanical weathering such as freeze-thaw and biological weathering such as plants (roots) and animals also affect the rate and level of erosion and landscape formation. Sediment traps in plant roots, binding together, and acting as a natural defence to erosion as the sediment particles get trapped in the roots of the plants. Chemical weathering such as carbonation and oxidation take place. Rainwater dissolves the limestone / chalk cliff face as it is made weaker, permeable rock.

Sample C

Biological weathering on the cliff faces by vegetation can cause cliff instability. The heavily fractured cliff face would be vulnerable to salt crystallisation (where crystals exert pressure) and freeze thaw action where constant freezing and thawing of water and ice also causes structural weakness. The seaward dip means the cliff is vulnerable to rock falls and slicing forms of mass movement.

Question 3 b

Explain why hard engineering approaches are still used to protect some coastal environments (8)

Question number	Answer
3(b)	**AO1 (8 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: • Hard Engineering approaches can consists of groynes, sea walls, rip rap, revetments, and offshore breakwaters. • Hard engineering approaches are used to protect coastal environments where the policy decision has been for Hold the Line or Advance the Line) but can be used as part of a strategic realignment policy (such as seawalls/flood embankments). • Hard engineering approaches are often used to protect some coastal environments when through Cost Benefit Analysis (CBA) the cost of the defences are outweighed by the economic benefits that will be accrued by having the defences such as the hard engineering approach adopted at Easington gas terminal. • Hard engineering approaches are also used to protect some coastal environments as a result of political as opposed to economic reasons
	such as the hard defences protecting the railway at Dawlish as a result of the desire to ensure a rail link for southern Cornwall. • Hard engineering approaches are also used to protect coastal environments as a result of social reasons such as the defences at Tywyn in south Gwynedd which cost £7.6m and will protect about 75 homes • Hard engineering is not used in some coast environments due to the environmental sensitivity of the coast such as the Hinge at the mouth of Chichester Harbour. • Hard engineering is not used in some coast environments due to considerations of engineering feasibility such as at Blackgang Chine on the Isle of Wight where the combination of high erosion rates and rapid mass movements mean that it is not feasible to use hard engineering approaches.

Sample A

Hard engineering is physical structures built to protect areas of land in danger of erosion.

One example of hard engineering is SeaWalls. In ~~Mappleton~~ Easington, Holderness coast, a £4.5 million seawall was constructed to protect the area. The wall refracts the wave energy, so the area is not eroded. However seawalls are very expensive, and also unbalances dynamic equilibrium, so erosion will be stronger in another area. This approach is used because it's effective, lasts a long time, and a CBA shows it's beneficial for the area. //

Another approach is Groynes. These are used in areas such as Mappleton - Holderness Coast. These build up mounds of sand to prevent erosive longshore drift and to break the energy of destructive waves. However, once one rots, it results in terminal groyne syndrome, and they're expensive - over £2 million. But they are used because they're quite long term, and effective at protecting the area from erosion.

In conclusion, hard engineering is used as it's an easy way of combatting erosion, even though it's not always sustainable and can have worse erosive effects on other areas, they're most effective for protecting coastal areas.

12

Sample B

Hard engineering is works against natural processes to form long-term, solid methods of protection.

For example, groynes are used in Swanage Bay, Dorset to intervene with LSD; slowing down the rate of erosion. These are effective and long-term, but can be expensive and disrupt the dynamic equilibrium of sediment cells. However hard engineering is used over soft engineering for many reasons. For example, in some areas soft egineering isn't enough alone, as erosion happens at a fast rate (Swanage Bay). Also, soft engineering often needs a lot of maintenance such as beach renourishment whereas hard engineering is more convenient and left for long-term purposes. They are more effective, last longer, can work at cheaper in some cases and provide better protection for certain coastline. Some high value land cannot be risked so hard engineering is needed as a form of protection. For example, for residential areas or buisnesses and animal habitats - especially that of endangered species etc.

Sample C

~~High~~ ~~eee~~ Land with a high economic value must be protected using effective defences in a cost - benefit analysis. For example, Deltaworken mega-project in the Netherlands currently costs around $1.1 billion ~~p~~ a year to maintain, however much of the countries GDP is reliant on ports, such as Rotterdam. Soft engineering would not have been as effective. Despite it being cheaper and often working with natural processes. the success isn't as good. For example, cancun in Mexico uses beach replenishment. however this requires constant maintence and intense human activity on the dunes ~~this~~ here means it is not as effective. The Holderness coast uses groynes (hard) at Mappleton to protect the large town. this stops longshore drift. trapping sediment, acting as a natural buffer. However, this comes with the cost of increased erosion at Great conden due to terminal groyne syndrome. In conclusion, hard engineering is used to protect ~~of~~ valuable land as it is very effective.

Question 3 c

Study Figure 3b

Evaluate the view that climate change is the most important factor in influencing coastal flood risk. (20)

Question number	Answer
	Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • Climate change may increase risk through raising sea levels through eustatic sea level rise • Climate change may also increase risk as a result of the increase in the magnitude and frequency of storms leading to greater number of storm surges • Rapid population growth in low lying coastal areas will also increase the risk of coastal flooding. • Risk is also dependent upon the density of population as well as the level of coastal defences • Risk may also increase due to subsidence (isostatic downwarping) **AO2** • Key to understanding the role of climate change in influencing coastal flood risk is in understanding what constitutes risk • Importantly, risk consists of two key elements - physical factors increasing or decreasing the likelihood of coastal flooding and human factors that increase or decrease the likelihood of coastal flooding • The crucial physical factor caused by climate change in determining coastal flood risk is eustatic rises in sea level. Cities such as New York will have a near doubling of population at risk as a result of a projected increase of up to 71cm in sea level. • Another key physical factor linked to climate change are the increase in the magnitude and frequency of storm events. These will increase the storm surges associated with tropical revolving storms and so cities such as Miami which are the track of hurricanes will have an increase in the coastal flood risk of particularly in terms of the economic value which is set to rise to $3500 billion by 2070. • Yet there are other physical factors that determine coastal flood risk that are unrelated to climate change. Another key physical factor is that some low lying cities such as Dhaka will see increases in coastal flood risk of some 400% due to isostatic downwarping. • However, human factors also play a crucial role in influencing the increases in coastal flood risk. Areas that are physically vulnerable to coastal flooding but have high value land values or high value installations or high population densities are protected with a hold the line policy such as Shanghai and so have a low value of property at risk ($1775 billion). • Yet other areas that are physically vulnerable to coastal flooding due

Question number	Answer
	to their low lying nature will not have the same levels of protection due to lower levels of economic development and so cities such as Mumbai will have a quadrupling of people at risk as well as an increase in property at risk of $2150 billion. • Furthermore in some cities such as Kolkata rapid population growth as well as high population densities are the main causes of the increase in future population at risk of nearly 12 million people and an equivalent value of properties at risk as New York. • Climate change will therefore dramatically increase the coastal flood risk in low lying vulnerable areas that are not protected. • It will also increase the risk in those areas that are vulnerable to storm surges • Yet the rate of temperature rise is however uncertain leading to uncertainties to the extent of sea level rise. • In addition other physical and human factors are also key in determining the increases in future flood risk. • Climate change is therefore only one factor in influencing the increases in coastal flood risk and it is likely that it is a combination of both physical and human causes that determine the differences in the increases shown in the table. Dhaka in particular highlights how a low lying area will undergo both eustatic and isostatic sea level change but will also be impacted by an increase in the magnitude and severity of cyclones as well as increases in population yet will not be able to protect all of the increase in population.

Sample A

6 The most significant factor of climate change is thermal expansion, which amounts to 60% of the cause. Other factors are isostatic and eustatic change. Thermal expansion is the volume of the sea expanding due to heat.

As shown in figure 3b, Dhaka has the ~~population~~ greatest growth of population at risk - rising by 103,060,000 people. This is because as Bangladesh is low lying, it is very vulnerable to floods. Climate change - mainly thermal expansion means that over 60% of the country will flood leading to contaminated water supply, and disease. However, climate change may not be the most important factor, as 70% of mangroves have been removed in place of shrimp fisheries. Also human factors, such as poor defences, ~~and~~ lack of warning and poor sanitary means that a greater population will be at risk. Furthermore, as Bangladesh is a LEDC they cannot afford new defences such as flood walls which will worsen the problem. Furthermore, in Shanghai, a mega-city in China as shown in figure 3b, already a huge number of the population is vulnerable - 2,500,000 people, which ~~is~~ is predicted to double by 207©

one could say that climate change is caused by human factors as China 'The workshop of the world' hugely pollutes the environment, which is a causation of thermal expansion and isostatic change - such as glaciers melting. Therefore climate change is the most important factor because it will lead to loss of land, livelihoods and infrastructure.

Lastly, one could argue that the cities at risk (Fig 3b) are the main contributors to climate change. China and India equate to 37% of the worlds population, and global warming can have serious affects on places such as the Maldives. If the sea level rises by 50cm, 70% of the land will be lost. **(Total for Question 3 = 40 marks)**

TOTAL FOR SECTION B = 40 MARKS

In conclusion, I strongly agree that climate change is the main factor of coastal flooding, because as figure 3b shows, major industrial areas are highly at risk and are major contributors to global warming. Furthermore, climate change causes warming of the planet

which leads to factors such as thermal expansion. # Thermal expansion is 60% of climate change, and for areas such as Bangladesh and the Maldives, as they're low lying, any change in sea level would lead to major areas of land lost.

Sample B

Climate change occurs due to global warming, the climate is getting warmer and sea levels are rising as a result. The current rate of sea-level rise is 3mm a year, increasing from only 1.88m in the ~~last~~ past 20 years.

Climate change is an important factor in influencing coastal flood risks, as it causes sea-levels to rise, (3mm p/y) and so, naturally, more coastlines are submerging due to this. Places such as the ~~Maldives~~ The Maldives are submerging over the years and this cannot be helped in this particular case therefore the population needs relocating. Climate change holds a huge amount of blame for ~~the~~ coastal flood risks but is there are to also other ~~natural~~ factors influencing coastal flood risks.

For example, isostatic change is when ~~ice~~ the ~~heavy ice has~~ water has frozen over land, causing the heavy ice to weigh down the crust. When this melts the crust rebounds and the ice caps/sheets melt, adding to the ~~sea~~ ever increasing sea-level. Eustatic change is a global change, as

land submerging and sea levels rising.

Marine transgression is when sea levels rise, (causing the coastline to be submerged), these are called submergent coastlines.

Heavy rainfall causes sea-levels to rise as the amount of water & perspiring can add up if in one place, increasing the sea-level overall.

Bangladesh has a huge population at risk, 844,000 with a cost of $400 bn in property value. The population is increasing and so in the future there are estimated to be 11,150,000 people at risk.

Therefore, climate change is important but there are other factors involved in influencing & a coasts flooding risk, such as rainfall, and type of coastline, including the defences in place (Total for Question 3 = 40 marks)

or lack of defences in place. TOTAL FOR SECTION B = 40 MARKS

Sample C

Climate change mostly refers to global warming. There are numerous causes of coastal flooding, and all must be considered.

Rising global temperatures causes rising sea levels due to thermal expansion. The IPCC 2014 Report stated a 4mm per year rise in sea level was likely, however an increased frequency of storm surges was un-certain. Although sea level rise causes are debatable, the fact that Climate change is a main cause isn't (melting of ice caps) A higher sea level means storm surges have a higher starting point and existing defences won't be high enough. Here Climate change can be seen as a factor

Human actions can result in changes to the landscape which can increase flood risk. In Bangladesh polders in farms subsided and turned to lakes in the 2007 cyclone Sidr. The high tide in the Bay of Bengal, Stronger from the Himalaya's and the fact that 44% of the population live less than 10m above sea level also contributed to a high

coastal flood risk. Figure 3b shows, despite a small current population in Dhaka, the future population at risk is comparitively high. This is perhaps evidence that climate change is not the most important factor. ~~Deforest~~

Deforestation also influences the degree of risk. Mangroves in Dhaka are being removed for shrimp farming - retreating in excess of 200m per year in some places. The USAs deep-rooted trees, in comparison, ~~can~~ a intercept rainwater allowing a less saturated ground.

In conclusion climate change is not the most important factor. The complex human - physical interactions globally, and the lack of data on wind speed and wave height means it would be wrong to put climate change as the single root cause of increasing risk to coastal flooding.

(Total for Question 3 = 40 marks)

TOTAL FOR SECTION B = 40 MARKS