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June 2018

GCE Geography 9GE0 01

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Introduction

The June 2018 paper for Advanced GCE in Geography, Paper 1 (9GE0_01) was generally accessible to candidates across the ability range and it was pleasing to see that there was evidence of high quality work that was awarded the highest marks in all the high mark tariff questions. In terms of the two option questions, Coastal Landscapes and Change (Q3) was far more popular than Glaciated Landscapes and Change (Q2).

There was, however, some evidence of non-completed scripts as well as evidence of some candidates only briefly answering the 20-mark extended writing question in Section C. Candidates that fell into these two categories were often those that had used extra paper for many of the previous questions, particularly the 12-mark extended writing question related to the assessment of tectonic hazards in Section A.

It is important for Centres to impress upon their students that the mark tariff and the number of lines printed in the examination paper are indicative of how long they should spend on each question. In fact, there are examples of candidate work in this report that had obtained the maximum mark available and had continued to expand upon their answer. In other instances, where answers to 'assess' or 'evaluate' type questions were often largely descriptive, the extra pages did not materially affect the result. In these cases, candidates had failed to meet the criteria of the top mark bands, which requires a full and coherent interpretation of the question that allows them to come to a rational and substantiated conclusion, fully supported by a balanced and coherent argument. In these types of questions there was evidence that some candidates were prioritising quantity over quality.

There was also some evidence of candidates not reading the questions carefully and so missing out on key words contained within the question. For example, there was evidence that 'communities' simply became 'countries' in Q1b and 'winners and losers' became 'advantages and disadvantages' in Q3d. In this respect, it is difficult for candidates to access the highest marks available unless their answer is tightly focused on the question set. Centres should remind their students that they need to spend some time both reading the questions as well as planning their answers for the higher mark tariff questions.

Centres are also reminded to impress upon their students the exact meaning of the various command words used in the examination, which are explained on page 95 of the specification.

A particular problem seems to have been the 3-mark question in Section C (Q4a). Although the question asked for an explanation of the relationship between precipitation and soil moisture, many candidates merely described the relationship, even though they described all four soil moistures (surplus/utilisation/deficit and recharge), they were self-penalising without an explanation.

In contrast, candidates coped well with the demands of the AO3 skills questions in Section A, (Q1a). Many Centres had used the existing sample assessment questions to ensure that their students understood hypothesis testing. It is important for Centres to realise that equations for statistical tests, such as Pearson's r correlation and Student's t-test, will always be given.

Similarly, candidates coped well with the demands of the resource-linked questions in Section B, (Q2a/b and Q3a/b). As with the 12-mark extended writing 'assess' questions, there was evidence of some candidates overwriting for these relatively low mark questions. The extra writing often produced few extra marks as candidates had not read the question carefully enough. For instance, in both Q2a and Q3a, the questions explicitly asked for either the changes in the position of the snout of the Mer de Glace glacier or the variations in the rate of coastal recession in North Norfolk.

In many cases, candidates confined themselves to either the most obvious changes of the snout of the Mer de Glace glacier (from 1870 to 2010), or just the three named areas of the North Norfolk coast. Therefore, it was difficult to obtain maximum marks for candidates adopting such an approach as in both cases there was much to say for the areas of the resource not covered. Centres are encouraged to rehearse how to respond to photographs, data and maps, allowing candidates to deal with patterns, trends and, in the case of Q2a and Q3a, anomalies.

The extended writing questions in each section are those in which candidates are encouraged to use a range of examples or case study information to support their assessments or evaluations. The responses to these questions were often a pleasure to read with good knowledge and understanding throughout the 12-mark and 20-mark questions, with some pertinent and well supported conclusions.

There was, however, some concern over candidates' knowledge and understanding of the difference between mitigation and adaptation in Q4e. Furthermore, it was agreed that Solar Radiation Management (SRM) would be accepted as both a form of mitigation or adaptation.

Centres are encouraged to ensure that their students are comfortable with the definition of key words of the specification as candidates who either transposed mitigation techniques with adaptation adjustments, or simply wrote about mitigation techniques, found it difficult to access the higher marks for this question.

Question 1 (a) (i)

In this question, candidates were asked to calculate the average monthly frequency of earthquakes at two plate boundaries. Most candidates successfully managed to obtain the full 2 marks but a few did not show their mathematical workings and were awarded 1 mark. Some candidates calculated the monthly frequency at the plate boundaries separately, which was also acceptable.

Question 1a consists of a skills-based AO3 question.There is a comprehensive list of the skills at the end of each of the sections for 9GE0/01. Centres are reminded that the AO3 marks can come from any of the skills, not just the ones listed after the section on Tectonic Processes and Hazards.

SECTION A: TECTONIC PROCESSES AND HAZARDS

Answer ALL questions in this section. Write your answers in the spaces provided.

You must use the Resource Booklet provided.

1 (a) Study Figure 1a in the Resource Booklet and Figure 1b below.

This data in Figure 1b was collected to investigate whether there was a significant difference in earthquake depth at the two plate boundaries shown in Figure 1a.

	Number of earthquakes recorded in 2016	Mean focal depth of earthquakes (in kilometres)
Plate boundary A	186	34.8
Plate boundary B	145	12.7

Figure 1b

Frequency and focal depth of earthquakes in New Zealand, 2016

(i) Calculate the average monthly frequency of earthquakes at the two plate boundaries.

You must show your working.

(2)

$\frac{186 + 145}{12}$

27.58

ResultsPlus
Examiner Comments

This response is awarded the full 2 marks. The candidate has clearly shown their workings and correctly calculated the average monthly frequency of 27.58

ResultsPlus
Examiner Tip

Always show all your mathematical workings as 1 mark is available for this evidence.

Question 1 (a) (ii) - (iii)

In this question, candidates were required to calculate the value of t of the Student's t-test for 1 mark and to state whether there is a significant difference between the mean focal depth of the earthquakes for a second mark. Most candidates answered this question correctly. However, some candidates incorrectly rounded the calculation but were not penalised for the second mark.

(ii) A Student's t-test was used to determine whether there was a statistical difference in the mean focal depth of the earthquakes at the two plate boundaries.

Two hypotheses were tested:

Null Hypothesis: There is **no** statistically significant difference between the mean focal depth of earthquakes at the two plate boundaries.
Alternative Hypothesis: There **is** a statistically significant difference between the mean focal depth of earthquakes at the two plate boundaries.

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{{S_1}^2}{N_1} + \frac{{S_2}^2}{N_2}}}$$

Using the partially completed Student's t-test below, calculate the value of t.

(1)

$$t = \frac{22.1}{4.43}$$

t= 4.99

(iii) Study Figure 1c below.

Confidence level	0.10 (90% significance)	0.05 (95% significance)	0.01 (99% significance)
Critical value of Student's t-test	1.6	2.0	2.6

Figure 1c

Critical values for this Student's t-test

Using the Student's t-test value calculated in (a) (ii), state whether there is a significant difference between the mean focal depth of the earthquakes.

(1)

There is [redacted] significant difference between the mean focal [redacted] depth of the earthquakes.

ResultsPlus
Examiner Comments

In this response, the candidate has correctly calculated the value of t as 4.99 for 1 mark. The candidate also correctly identifies that there is a significant difference between the mean focal depths of the earthquakes at the two plate boundaries for the second mark.

ResultsPlus
Examiner Tip

Always ensure that whatever significant figures you use, you round up correctly. In this case, 4.99 is correct but 4.9 is not.

Question 1 (b)

This was the first of the new style extended writing question. It is a 12-mark, as opposed to a 15-mark, 'assess' question.

It was pleasing to see how well most candidates had been prepared for this question, with many having detailed and accurate case study material involving earthquake events. Unfortunately, a substantial number of candidates compared the impacts of two earthquake events (typically Haiti 2010 and Tohoku 2011), with little assessment of the reasons why some communities in Haiti were more vulnerable to earthquake events than others.

Another common mistake was to ignore the word 'community'. Although at a basic level, the 'community' of people in Haiti can be compared to the 'community' of people in Japan to obtain high marks, candidates would be expected to state why some communities, such as older people, were more vulnerable than others.

The best candidate responses tackled the question by assessing the reasons, as shown in the following example.

(b) Assess the reasons why some communities are more vulnerable than others to tectonic hazards.

(12)

Vulnerability has many aspects, which combine to determine the overall risk to a community. Several factors have an influence on vulnerability and its global variation, each with a different degree of significance. One of the most obvious reasons for variation is the level of development within a country or community. Economically, ~~have~~ greater development can provide communities with more money to fund adaption and mitigation strategies against hazards, and also increase their capacity to cope in the event of a hazard or disaster. However, greater economic development can also act to increase vulnerability as there are more expensive buildings, homes and businesses to be lost. Therefore, economic development has a significant effect on a community's ~~with~~ vulnerability.

In addition, social development and political development also ~~have~~ contribute to vulnerability. In a corrupt political society, money that may be intended for hazard protection may instead be used elsewhere, thus increasing vulnerability. Furthermore, weak governance (which is often associated with corruption) can result in poor implementation of protective measures, thus reducing the effectiveness of a hazard mitigation/adaptation defences, which can increase vulnerability.

Social development is strongly influenced by the economic and political development of communities. Greater development allows for more spending to educate communities on hazards, and as a result, perhaps greater local participation in evacuation drills, plans etc which can be

implemented to increase community preparedness and reduce vulnerability. Besides development, the physical presence of hazards can affect community vulnerability. Of course, in areas such as multiple hazard zones (such as the Philippines) the vulnerability of communities is higher as more hazards create greater risk. This is often made worse by the remoteness of many communities in places like the Philippines, as they have less ease of access to aid or assistance. Also, remote areas are often less developed than urban, which links back to the suggestion that lower development increases vulnerability.

Therefore, it is evident that vulnerability is strongly linked to development, as this impacts preparedness, education and agences which are key in reducing vulnerability.

ResultsPlus
Examiner Comments

This response gained Level 3 and scored 11 marks. The candidate has demonstrated accurate and relevant knowledge of why some communities are more vulnerable to tectonic hazards. The response makes relevant connections to produce a full and coherent interpretation that allows the candidate to make supported judgements within a balanced and coherent argument.

ResultsPlus
Examiner Tip

This answer could be improved by a greater focus on the key words of the question, in this case 'communities', as well as some detailed case study material.

Question 2 (a)

This question tested the candidates' understanding of both short and medium term changes in the climate that could result in the advance or retreat of glaciers. Using the Mer de Glace as an example, the resource material clearly showed that there was advance during the period of the Little Ice Age and more recent retreat caused by global warming. The resource material also showed that even within these two broad periods there was substantial change in the position of the snout of the glacier.

A few candidates described the resource material in great detail but unfortunately offered no explanation for the observed changes. These answers were therefore self-penalising, particularly in the time taken to describe in detail all the fluctuations of several hundred years

The best candidate responses identified both periods of change and related it to the resource material, as shown in the example.

SECTION B: LANDSCAPE SYSTEMS, PROCESSES AND CHANGE

Answer ONE question in this section – EITHER Question 2 OR Question 3.

Glaciated Landscapes and Change

Indicate which question you are answering by marking a cross in the box ☒. If you change your mind, put a line through the box ☒ and then indicate your new question with a cross ☒.

If you answer Question 2 put a cross in the box ☒ .

You must use the Resource Booklet provided.

2 Study Figure 2a in the Resource Booklet.

(a) Explain how changes in the position of the snout of the Mer de Glace may provide **evidence** for changing climate.

(6)

Changes in the position of the snout of the Mer de Glace may provide evidence for changing climate as the snout can be used to assess how much a glacier has retreated. For example, higher temperatures ~~more melting~~ leads to more meltwater, which increases basal sliding and causes the Mer de Glace to retreat faster, such as post industrial revolution and from 1930s onwards in particular. The position of the snout of the Mer de Glace also provides evidence for past climates. Terminal moraine created by the movement of the glacier indicates that during the little ice age the glacier had advanced due to cooler temperatures. The current position of the snout displays how much it has retreated since then. Between 1570 and 1800, the glacier snout had a much larger extent, indicating a much cooler climate.

ResultsPlus
Examiner Comments

This response gained Level 3 and scored 5 marks. The candidate has demonstrated accurate and relevant knowledge of how the changing position of the snout of the Mer de Glace may be used to show changes in climate by finding fully relevant connections between the resource and the question.

ResultsPlus
Examiner Tip

This answer could have been improved by also explaining that within these two broad periods there are variations for changing climate with possible warmer and colder years within each period.

Question 2 (b)

This question tested the candidates' understanding of the processes that drive glaciation and used a widely available model to do so.

The best answers correctly identified the processes occurring and related the theoretical diagram explicitly to temperate glaciers, as opposed to glaciers in general, as shown below.

(b) Study Figure 2b in the Resource Booklet.

Explain the processes that affect the mass balance of temperate glaciers.

(6)

There are multiple inputs & out puts within a glacier, Temperate glaciers tend to retreat and advance far more often than cold based glaciers. One reason is changing precipitation levels due to seasons. As the winter arrives cold air forces vapour to condense into snow, which acts as the primary input in the glaciers accumulation zone, adding to the mass balance. Another process can be avalanches from other parts of a valley, which contribute to the glaciers newly accumulated mass. The opposite may occur during warmer months such as June, the mass balance of temperate glaciers will often fall due to ablation, evaporation & meltwater loss. Meltwater occurs when glacial ice turns to liquid state, and it can be due to hydrostatic pressure as temperature rises, this decreases the mass balance as the glacier loses it's snow. ~~On~~ The process of evaporation occurs when supra/sub glacial streams turn to vapour, & it is often a result of contact with the sun, Temperate glaciers recieve more sunlight annually, as they're closer ~~to~~ the equator, meaning evaporation & ablation play a crucial role in ~~the mass~~ changes in Mass balance.

ResultsPlus
Examiner Comments

This response gained level 3 and scored 6 marks. The candidate has demonstrated accurate and relevant knowledge of the processes affecting the mass balance of temperate glaciers by finding fully relevant connections between the resource material and the question.

ResultsPlus
Examiner Tip

Candidates are reminded to read very carefully every word in the question. There will often be key words, such as 'temperate', that must be addressed if full marks are to be awarded.

Question 2 (c)

In this question, candidates were asked to explain the role of glacial meltwater in creating distinctive landforms. Most candidates completed the first of the AO1 knowledge and understanding questions to a high standard.

The best candidate responses tackled the discriminatory word 'distinctive' by comparing the ice contact and pro glacial features, as shown in the following response.

9:36
9:44

(c) Explain the role of glacial meltwater in creating distinctive landforms.

(8)

Glacial meltwater is the product of melted ice from a glacier. It may contain sediment of various sizes.

Glacial meltwater can create numerous landforms in glacial environments. If the melt water is trapped underneath the glacier it it can carve out a subglacial stream. Because of the pressure from the glacier above the meltwater is capable of carrying sediment with it, depositing sediment that is too heavy. This deposition in a subglacial stream creates an Esker when the glacier retreats. Melting along either side of the glacier can create kame Terraces, where larger sediment is deposited between the glacier & the valley walls, eventually leaving behind piles of gravels or conglomerates. An outwash plain is also created this way, with the glacial water out of the glacier carrying sediment, with the heavier sediment deposited early on & lighter sediment being deposited later, creating graded bedding. ~~Overall~~ ~~Overall~~ Finally, ravines can be created when a post glacial lake or ribbon lake freezes pushing all the sediment out of solution to create distinctive layers of clay sediment & Gorges gorges. Overall, as meltwaters ability to carry sediment & deposit it leads to the creation of many landforms, while glaciers shape the environment that the landform is in & provide the sediment.

ResultsPlus
Examiner Comments

This response gained level 3 and scored 6 marks. The candidate has demonstrated a range of accurate and relevant knowledge of how glacial meltwater creates distinctive landforms, which were detailed and fully developed.

ResultsPlus
Examiner Tip

In all AO1 8-mark questions based on landforms, it is good practice to name individual landforms to ensure that the highest marks within the level can be gained.

Question 2 (d)

Most candidates found this question accessible. Candidates were required to evaluate the view that tourism poses the greatest threat to both active and relict glaciated landscapes. This could be demonstrated either by showing how tourism poses a threat that could be reduced through management or by comparing the level of threat to other threats, such as climate change.

Good candidate responses demonstrated a clear evaluation and focused on both active and relict landscapes, as shown below.

(d) Evaluate the view that tourism poses the greatest threat to both active and relict glaciated landscapes.

(20)

Tourism and other factors pose a threat to active and relict glaciated landscapes in different ways which are more or less important than others.

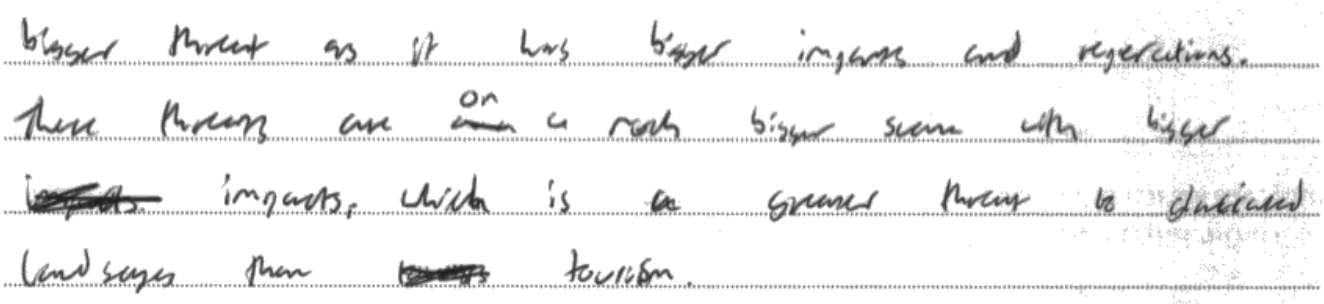
Tourism does pose a threat to glaciated landscapes. ~~and is~~ For example large ~~quantities~~ masses of tourists visiting a glaciated landscape can have many negative effects. The disturbance of the landscape in way of building, transport and visits on glaciers themselves can encourage melting of the glaciated landscape and damage the local climate. Without the introduction of tourists, the glaciated landscapes can be preserved and kept in a natural state. Threats from tourist pose such as rubbish, pollution, local warming of the climate due to cars and other transportation and the greatest threat to glaciated landscapes.

However, some would argue that tourism isn't the greatest threat towards glaciated landscapes. Threats such as climate change are seen as a bigger threat. The warming of the climate has a direct impact on glaciated landscapes. The melting and retreat of glaciers is part of the threat that climate change is. Also, with future projections for an increase in climate temperature, we could see our glaciated landscapes destroyed resulting in ~~sea~~ sea level rise. Some would argue that climate change is natural and out of our

control, but the enhanced greenhouse effect has been proven to warm the climate and by 2020 the global temperature will have risen by at least 2 degrees. This results in a great threat towards glaciated landscapes which then leads onto other global changes.

Another huge threat to glaciated landscapes are direct human activities. The Arctic Ice Sheet holds billions of gallons of oil which is untouched. However with increasing demand for fossil fuels as a result of increasing population dynamics, this area of land is heavily disputed by 7 countries. If a decision was to go ahead and extract these resources the consequences would be huge and potentially catastrophic. The mass drilling and construction would greatly affect the glaciated landscape increasing the melting of Ice and mass waste. The consequences of this are irreversible and include loss of habitat and wild life, increasing sea level which puts low lying countries (Netherlands) at risk of flooding. Increased greenhouse gas concentrations as carbon will be released from it's stores into the atmosphere.

To conclude, I don't think that the view of scientists is the greatest threat to glaciated landscapes as it is on a small scale over a long periods of time with small direct impacts. Threats such as enhanced greenhouse effect and human actions for resources are much more of a



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Examiner Comments

This response gained level 3 and was awarded 14 marks. The candidate has demonstrated some relevant geographical knowledge and understanding, and with some logical connections, in order to produce a partial but coherent interpretation.

ResultsPlus
Examiner Tip

This answer could be improved by having more AO1 knowledge to support the answer, as well as a tighter focus on the differences between active and relict glaciated landscapes.

Question 3 (a)

The resource material showed the rate of coastal recession in North Norfolk with information on the management approach at three sites along the coast. This was testing the understanding of how effective different management approaches have been, as well as the impacts of other possible factors in determining the rate of coastal recession.

The best candidate responses recognised the key word 'may' and explained other reasons for the variations in the rate of coastal recession, as shown below.

Coastal Landscapes and Change

Indicate which question you are answering by marking a cross in the box ☒. If you change your mind, put a line through the box ☒ and then indicate your new question with a cross ☒.

If you answer Question 3 put a cross in the box ☒.

You must use the Resource Booklet provided.

3 Study Figure 3a in the Resource Booklet.

(a) Explain how variations in the rate of coastal recession in North Norfolk may provide **evidence** for the different approaches to coastal management.

(6)

A lower rate of coastal recession indicates erosion of the coast is being reduced by any mixture of various factors, which could be credited by coastal management schemes. (from fig 3a) Cromer, where a sea wall and groynes are implemented, appears to not have no recession, at all of the the coastline. This could be due to the hard engineering in place. Similarly, Overstrand, with primarily soft engineering sees a higher, but low, rate of recession still (less than 0·5 meters per year). Additionally Trimingham where there is no intervention, has very high rates of recession (with an average of 2 meters per year). This could provide evidence for the high success of hard management over soft over none. // This is, however, only if the geology along the coast and off affected locations remains equal, and the wave energy eroding is equal. Looking between the given locations suggests bands of differently resistant rock, which would affect differential recession with or perhaps without management.

ResultsPlus
Examiner Comments

This response gained level 3 and was awarded 6 marks. The candidate has demonstrated accurate and relevant knowledge of how variations in the rate of coastal recession may provide evidence for different approaches in coastal management by finding fully relevant connections between the resource material and the question.

ResultsPlus
Examiner Tip

When there is a resource covering the whole of the north Norfolk coast, candidates are expected to not only comment on the named places but also the other rates of coastal recession.

Question 3 (b)

In this question, candidates were required to explain the physical processes that affect the rate of coastal recession. The resource material clearly showed a variety of physical processes such as erosion, weathering and mass movement.

The best candidate responses correctly explained marine and sub-aerial processes, as shown below.

(b) Study Figure 3b in the Resource Booklet.

Explain the physical processes that affect the rate of coastal recession.

(6)

The rate of coastal recession is affected by biological weathering at this section of the Irish coast. The existance of plants results in cracks and fissures in the rock as roots bind to the soil. This creates joints in the cliff face that are more vulnerable to erasion as sediment breaks away. The vegetation cover also reduces surface runoff in a precipitation event and as a result the water permeates the soil and creates a high pore water pressure, leading to mass movement events. The rate of coastal recession is further increased through attrition of previously eroded sediment. The particles of sediment collide in the sea and are gradually eroded to become smaller in size. As a result, less deposition occurs and the cliff is more vulnerable to erosion because less of the wave energy is dissipated prior to impact. Hydraulic action / wave quarrying also occurs when water and air is forced into the many bedding planes and cracks in the cliff face. Over time this causes cracks to increase in size and sediment is eroded. Similarly, the unconsolidated, low-resistance quality of the sediment increases the rate of erosion by abrasion as sediment is hurled at the cliff face when carried in suspension. This causes sediment to be removed and transported along the coast. As a drift aligned coast, longshore drift transports the eroded sediment along the coast, and so a beach is unable to accumulate.

ResultsPlus
Examiner Comments

This response gained level 3 and scored 6 marks. The candidate has demonstrated accurate and relevant knowledge of how physical processes affect the rate of coastal recession by finding fully relevant connections between the resource material and the question.

ResultsPlus
Examiner Tip

This is an excellent response which had probably gained the full 6 marks before the last paragraph. Candidates are reminded that the number of lines given in the examination paper indicate the length of the response required.

Question 3 (c)

In this question, candidates were asked to explain the role of sediment transport in creating distinctive landforms. As with Q2c, this AO1 knowledge questions was completed to a high standard by many candidates.

The best candidate responses tackled the discriminatory word of 'distinctive' by comparing the size and shape of macro features, such as spits and tombolos, with micro features, such as beach landscapes including berms, ridges and runnels.

(c) Explain the role of sediment transport in creating distinctive landforms.

(8)

Transport of sediment is key to the formation of landforms, particularly depositional landforms. Sediment is transported in water in many ways (traction, saltation, suspension and solution), allowing sediment of varying size to eventually be deposited elsewhere. Depositional landforms, such as spits, bars, and tombolos are reliant on the transportation of sediment in order to form. Sediment is transported in rivers (by the methods stated previously) to the coast, which can then allow the formation of beaches. Longshore drift can then occur to move the sediment along the coastline. Landforms such as spits can then form when the sediment continues to be transported along the coastline and is then deposited (either due to flocculation or gravity settling) and builds up over time to form an extended land mass out from the coast.

This land can then be stabilised by vegetation, allowing coastal accretion which results in the distinctive depositional landforms seen on various coastlines globally.

This process also occurs in the formation of features such as bars, where sediment is deposited and accumulates offshore after being transported. These are often influenced by transportation within sediment cells, resulting in sediment build up offshore.

The main processes that result in the formation of these landforms are traction and saltation, as these move larger pieces of sediment, which are then more easily deposited to then form the depositional landforms discussed.

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Examiner Comments

This response gained level 3 and scored 6 marks. The candidate has demonstrated a range of accurate and relevant knowledge of how sediment transport creates distinctive landforms, which were detailed and fully developed.

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Examiner Tip

In all AO1, 8-mark questions based on landforms, it is good practice to name individual landforms to ensure that the highest marks within the level can be gained.

Question 3 (d)

Most candidates found this question accessible. Candidates were asked to evaluate the view that hard engineering approaches to coastal management produce more winners than losers.

The main aspect to this question was identifying the various stakeholders that could become winners or losers. Evaluating the view that hard engineering could produce more winners than losers could be through either one stretch of coastline, typically the Holderness, or a variety of coastal areas.

gov. locals environment.

(d) Evaluate the view that hard engineering approaches to coastal management produce more winners than losers.

(20)

Hard engineering often involves lots of technology and is also sometimes considered a very drastic approach. There are many arguments for and against it as it often provides a combination of winners and losers. What must be determined is whether the benefits and for the winners outweigh the problems for the losers, as only then can it be fully justified. Within most groups, there are bothe winners and losers. One key group is government (both local and national), as they are often the group in control of coastal management. Hard engineering is normally very expensive, and so can be a significant drain on government money, however unlike soft engineering, it is usually a one-off solution and so may reduce costs long-term. Furthermore, use of hard engineering can protect key industries and attractions in coastal areas, from which the government may receive revenue, taxes, or simply use to attract people to the area. Therefore, hard engineering is arguably beneficial to governments.

A good example of this is along the Holderness Coast, where coastal towns like Hornsea and Mappleton have used hard engineering such as sea walls in a 'hold the line' approach which has protected local business.

This example can also be applied to local residents, who arguably can be both winners and losers of hard engineering. Those whose homes are protected by the hold the line approach in Hornsea and Mappleton are of course winners, as their homes (which are a major financial asset) are protected. This is also true for people whose businesses or

agricultural land are protected as a result of the hard engineering. On the other hand, ~~any~~ the use of hard engineering can sometimes be an eyesore and destroy the natural beauty of the area. While this in itself could make local people losers of the project, the main issue with this is it can deter tourism. In heavily protected areas, the natural aspect is lost and people may look for other areas to visit as an alternative. this can lead to closure of businesses and therefore loss of jobs as the tourism industry declines.

Despite this, hard engineering can sometimes be carried out in such a way that tourism is maintained. A good example of this is Swanage, where groynes and sea walls are in place, but thousands of tourists still visit each year. Therefore, while there is a risk that there will be some losers among local residents, overall the benefits tend to outweigh the costs.

Another key group are environmentalists, who focus debate on the environmental and ecological impact of coastal management. There are of course some environmental advantages to hard engineering, as it may help preserve key environmental sites or maintain local habitats. However, many environmentalists disagree with the very industrial appearance of a lot of hard engineering schemes. Therefore, they may be considered losers, with the exception of circumstances when key environmental sites are protected.

Arguably, the main losers of hard engineering are those who live along the coast from where it is implemented. Use of measures such as groynes can starve areas of sediment, thus worsening conditions for local people there. However, hard engineering is mostly used in

areas where its benefit is thought to outweigh this cost.
Therefore, overall the view that 'hard engineering produces more winners than losers' is justified. It provides benefit to governments, local people and can protect key habitats/environments. While there are losers (particularly those along the coast from the site of hard engineering projects), the overall benefits are felt by a greater number of people than those who experience the costs.

ResultsPlus
Examiner Comments

This response gained level 4 and was awarded 16 marks. The candidate has demonstrated accurate and relevant knowledge of whether hard engineering creates more winners than losers. The response makes relevant connections to produce a full and coherent interpretation that allows the candidate to come to a rational and substantiated conclusion fully supported by a balanced and coherent argument.

ResultsPlus
Examiner Tip

This response was strong on stakeholders but could have been improved by having more AO1 knowledge to support the answer.

Question 4 (a)

In this question, candidates were asked to explain the relationship between precipitation and soil moisture. The resource material showed a water budget for a Mediterranean type climate, in this case Cloverdale in California, and tested candidates' understanding of soil moisture budgets.

Despite the soil moisture status being indicated on the resource material (surplus, utilisation, deficit and recharge), as well as precipitation and evapotranspiration, a substantial number of candidates chose not to use the resource but instead stated the obvious relationship that when there are high levels of precipitation there are high levels of soil moisture. Although this was creditworthy to obtain full marks, candidates either had to use the information on the resource or explain how changes in precipitation drives changes in soil moisture, as shown below.

SECTION C: PHYSICAL SYSTEMS AND SUSTAINABILITY

Answer ALL questions in this section. Write your answers in the spaces provided.

You must use the Resource Booklet provided.

4 (a) Study Figure 4a in the Resource Booklet.

Explain the relationship between precipitation and soil moisture.

(3)

Figure 4a shows that when there is more precipitation, there are higher levels of soil moisture. This is because when it rains, the fluxes in the hydrological cycle (such as infiltration) ensure that the water reaches the soil. However, during a dry period, soil moisture decreases due to increasing levels of evapotranspiration.

ResultsPlus
Examiner Comments

This response clearly links precipitation to soil moisture status with an explanation and was awarded the full 3 marks.

ResultsPlus
Examiner Tip

In these 3-mark questions there will always be multiple routes in obtaining the maximum marks. Candidates only need to write one explanation that is extended to gain the maximum marks. Explaining all four soil moisture states would still gain 3 marks.

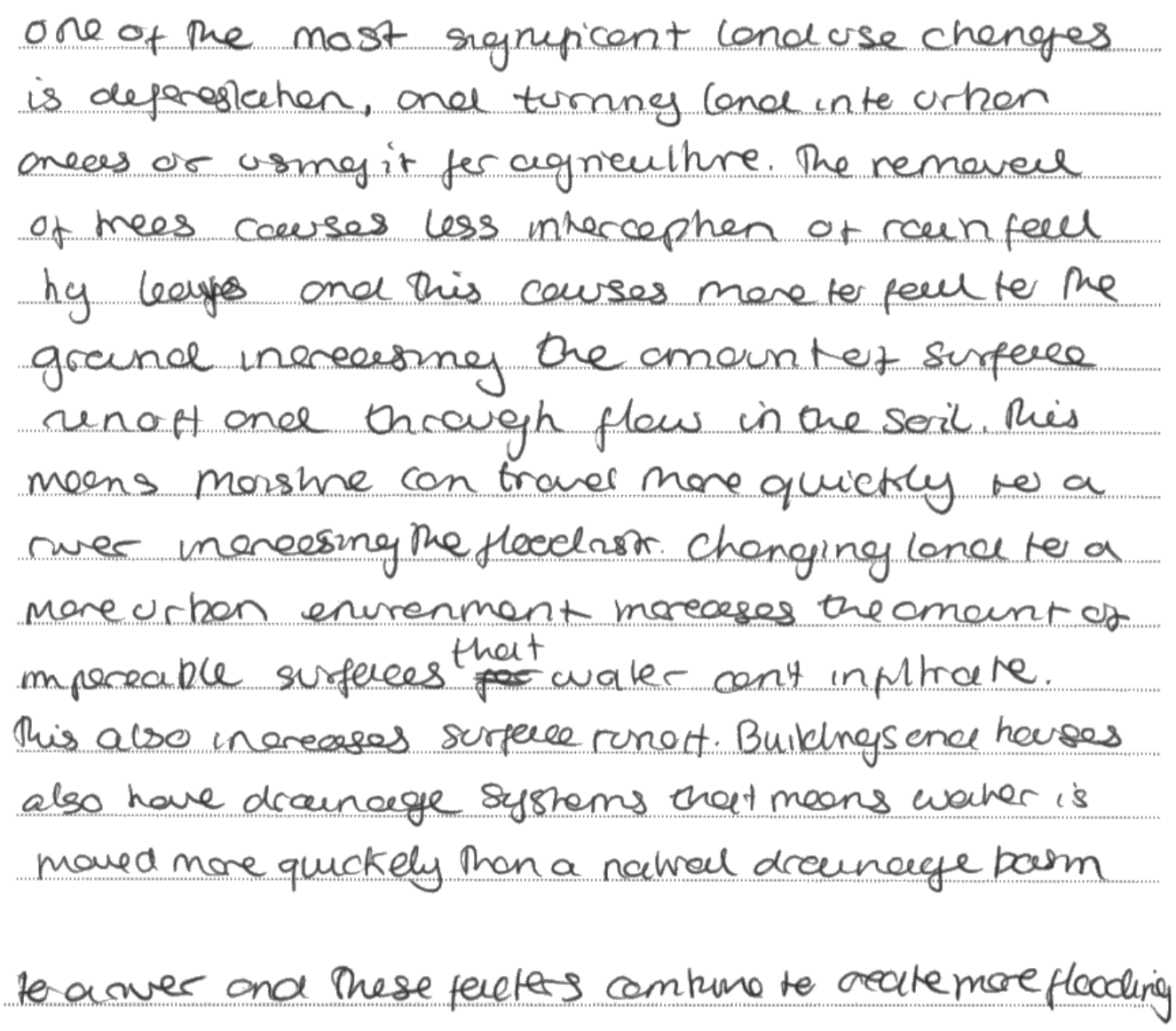
Question 4 (b)

In this question, candidates were asked to explain why land use changes can increase flood risk. Most candidates found this question accessible and it was answered well.

In this question, the main aspect to obtaining the full 6 marks was linked to the land use changes and how it might increase flood risk by decreasing lag time or overwhelming the existing flood defences.

(b) Explain why land use changes can increase flood risk.

(6)



ResultsPlus
Examiner Comments

This response gained level 3 and scored 6 marks. The candidate demonstrated a range of accurate and relevant knowledge of how land use changes can increase flood risk, which were detailed and fully developed.

ResultsPlus
Examiner Tip

Always study the question carefully. In this case, flood risk was the subject of the question, not increases in surface runoff, which was explained by a few candidates.

Question 4 (c)

In this question, candidates were asked to explain why the price of water varies globally. Surprisingly, as this topic has been carried over from the legacy specification, the question was not answered as well as expected.

Although there were some excellent reasons for the global variations in the price of water, a substantial number of candidates wrote in very simplistic terms equating high availability of water with low cost.

(c) Explain why the price of water varies globally.

(8)

Water varies in price as a commodity, costing around $0.10 for 50L in the UK, and increasing to over $2 in nations such as Tanzania. This is due to a number of factors, including availability, poverty of the nation or government strategy.

In India large depletion of water for the Coca Cola industry of over 300 million gallons a year, combined with their textiles industry means water left for human use is often low. As a result of lower availability, India's price for 50L, upwards of ~~$~~ $0.70 cents is almost 7 times that of the UK, which has sufficient water. A type of ~~lack~~ scarcity being physical water scarcity often impacts African nations such as Chad, who may have a smaller groundwater storage or availability, hence impacting price since availability is low. Similarly, Tanzania is one of the poorest nations in the world, therefore an economic water scarcity leads 50L of water to cost over $2, a high price. The government may not have the funds or technology to drill into deep groundwater, hence prices are high for what is available.

Lastly, ~~the~~ governance may be a reason for variation. In Singapore, caps on water usage and scale pricing is a holistic strategy used to combat excessive water usage, hence may end up costing more to deter instances of waste. This has worked, reducing usage from 165L a day to 150L between 2000–2015. Overabstraction in California may have led water prices to be higher, in order to prevent ~~aquifer~~ aquifer depletion

ResultsPlus
Examiner Comments

This response gained level 3 and was awarded the full 8 marks. The candidate has demonstrated a range of accurate and relevant knowledge as to why the price of water varies globally, which were detailed and fully developed.

ResultsPlus
Examiner Tip

The number of lines in the question paper indicates the length of the response required. This answer has given several reasons, with case study support, obtains full marks and is still within the recommended length.

Question 4 (d)

This question assessed candidates understanding of the carbon cycle, specifically the relative importance of the stores and fluxes of the carbon cycle in the ocean, as well as the relative importance of the ocean within the global carbon cycle. Therefore, a response on either of these aspects was acceptable.

In this question, there were examples of very high-quality work but also some fundamental misconceptions over the functioning of the carbon cycle. A substantial number of candidates misunderstood both the 'biological' and the 'carbonate' pumps, particularly the role of photosynthesis in the 'biological' pump. There was, however, some excellent work with some candidates not only explaining the relative importance of the oceans in regulating the carbon cycle but also in assessing how this role might change in the future.

(d) Study Figure 4b in the Resource Booklet.

Assess the role of oceans in regulating the carbon cycle.

(12)

The ocean is one of the biggest stores of carbon it helps to maintain and balance the carbon cycle by absorbing it from the atmosphere and releasing it at the same time.

The ocean works by sequestering carbon from the atmosphere to be used by photosynthesising plants and photoplankton in the sea. This works as a biological pump as eventually the carbon containing organisms will die and fall to the bottom of the ocean to help in the process of rock reforming.

Along with this the oceans thermohaline currents help to bring cold nutrient and CO_2 rich water up to the surface where it warms. It can release the fresh CO_2 back into the atmosphere for respiring plants to use, and then the thermohaline currents cool the water and it eventually returns to the bottom of the seas

The ocean is also helping to reduce the impact of global warming. Excess CO_2 produced from burning fossil fuels can get absorbed by the ocean so it does not impact other aspects of life.

However in recent years there has been a change

to the ocean its getting warmer and more ~~acidic~~ acidic
its capacity for holding carbon is decreasing as warmer
oceans are able to store less, this could result in a positive
feedback loop where plants and humans eat and
burning fossil fuels gives out carbon and so does
the ocean increasing CO_2 in the atmosphere and
this continues and gets worse - upsetting the carbon cycle
the oceans play a huge role in regulating carbon
by sequestering it, releasing it and helping in the
formation of new rocks, yet if a tipping point
is reached then the oceans usefulness ~~may~~
may start to decrease

ResultsPlus
Examiner Comments

This response gained level 3 and scored 11 marks. The candidate has demonstrated accurate and relevant knowledge of the role of the oceans in regulating the carbon cycle. The response makes relevant connections to produce a full and coherent interpretation that allows the candidate to make supported judgements within a balanced and coherent argument.

ResultsPlus
Examiner Tip

In this example, the candidate uses good technical language, such as the biological pump and phytoplankton, and details the thermohaline circulation. In answering questions based on the carbon or hydrological cycle, students are encouraged to create their own glossary of key terms to be used in such questions in the future.

Question 4 (e)

In this question, candidates were asked to evaluate the view that mitigation strategies are more important than adaptation strategies in addressing the risks posed by the degradation of the carbon cycle. However, this question revealed serious concerns with candidates' preparation for the paper.

As an evaluative question, the mark scheme allowed for any substantiated argument to be accepted and it was disappointing to see that a substantial number of candidates were unable to distinguish between the two approaches. As a result, many of these latter answers that confused mitigation and adaptation were self-penalising as candidates were unable to contrast the advantages and limitations of each approach, but instead evaluated only one approach, usually mitigation.

CCS - prevents CO_2 - cost - essential

Afforestation - developing world - long time to grow

Renewable energy - can target impact on ecosystems

(e) Evaluate the view that mitigation strategies are more important than adaptation strategies in addressing the risks posed by the degradation of the carbon cycle. (20)

Flood risk management.

On a global scale the increasing amount of CO_2 in the atmosphere is significantly impacting the carbon cycle with reduced residence times and increased anthropogenic gas emissions. A number of mitigation strategies to prevent CO_2 from escaping into the atmosphere are implemented with other countries choosing adaptation strategies which reduce CO_2 emissions but don't compensate for all emissions also used.

It can be argued that mitigation strategies are very important at addressing the risks posed by the degradation of the carbon cycle. Carbon Capture storage which prevents 90% of all carbon dioxide emissions is being regularly tested across the USA. The main benefit to this strategy is a reduction of emissions on a local scale with places where CCS is used benefiting with the degradation of the carbon cycle reduced as less CO_2 is added to the atmosphere. The main economic cost of CCS and many adaptation strategies is the high cost. Across the developing world CCS is widely unaffordable and countries such as the largest emitter in the world China not investing, the importance of mitigation strategies are reduced.

Moreover, the need for investment in adaptation strategies such as Solar radiation management is too high. Although solar radiation management is applied on

a global scale would reduce atmospheric temperatures increased investment would be needed across many IGOs. The main benefit to adaptation strategies such as solar radiation management is decreased temperatures. This would benefit both the carbon and hydrological cycle as drought severity would decrease. Less evapotranspiration would occur meaning the social costs of the carbon cycles degradation would be less extreme. Although in theory adaptation strategies are more sustainable, a global lack of investment reduces importance.

Mitigation strategies such as Afforestation are essential in order to address the risks posed by the carbon cycles degradation. Afforestation involves replanting trees to compensate for CO_2 released into the atmosphere. The main benefit is to photosynthesis with trees enabling CO_2 to be removed from the atmosphere allowing the biogeochemical carbon cycle to function. However, although this strategy is low cost due to lack of governance in the developing world the nature of this strategies importance is unknown. Overall, the potential benefits to both people and the environment are massive on a global scale. Therefore, this may suggest potentially mitigation strategies are more important.

Finally, the need for renewable energy as a mitigation strategy is very significant in addressing the risks posed

by the degredation of the carbon cycle. Renewable energy sources such as Tidal energy in South Korea are important to ensure risks to the carbon cycle are not accelerated. The main cost of renewable energy such as Tidal is the lack of a constant energy source. The potentially creates reluctance to switch to these fuels. Alternatively, many countries are on target to meet energy reduction targets. For example, Norway aims to be carbon neutral by 2050. Therefore, the long term benefits of switching to renewable energy are very important at addressing risks to the carbon cycle.

In conclusion, it is clear globally the long term impacts of mitigation strategies are more important than adaptation strategies. Despite this management is necessary to ensure mitigation strategies are effective for example governments role in switching to renewable energy.

(Total for Question 4 = 49 marks)

Although adaptation strategies are effective they still accelerate global warming reducing their global importance.

TOTAL FOR SECTION C = 49 MARKS
TOTAL FOR PAPER = 105 MARKS

ResultsPlus
Examiner Comments

This response gained level 4 and scored 16 marks. The candidate demonstrated accurate and relevant knowledge of whether mitigation strategies are more important than adaptation strategies in addressing the risks posed by the degradation of the carbon cycle. The response makes relevant connections to produce a full and coherent interpretation that allows the candidate to come to a rational and substantiated conclusion fully supported by a balanced and coherent argument.

ResultsPlus
Examiner Tip

Candidates are reminded that using the key words of the question, (in this case, the risks posed by the degradation of the carbon cycle) to structure their answers is good practice as it essentially focuses their answer on the question and reduces the chance of the essay starting to drift.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- Ensure you use the number of lines on the question paper as a guide to how long the answer should be. Candidates often achieved the maximum amount of marks before the end of the answer, but the work on extra pages, although geographically correct, could not obtain extra marks.

- Ensure that you read the 8-mark, 'explain' AO1 knowledge questions carefully looking for key words such as 'distinctive' which qualifies the question.

- Ensure you understand the requirements of the differences in the command words, particularly the differences between 'describe' and 'explain', as well as 'assess' and 'evaluate'.

- Ensure that, in the 20-mark 'evaluate' questions, both sides of the argument are treated equally and that it is not an explanation of why one side of the argument is correct.

- In addition, ensure that, in the 20-mark 'evaluate' questions, you come to a conclusion that is a logical outcome of your argument and has a key piece of information supporting your conclusion.

- Ensure that you have a glossary of key terms of the specification. Many candidates muddled 'mitigation' and 'adaptation'.

- Centres are also reminded to make full use of the 9GE0/01 presentations and example work that are available on the Edexcel website and Edexcel Communities.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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