Pearson
Edexcel

Mark Scheme (Results)

Summer 2019

Pearson Edexcel A Level
In Geography (9GE0) Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number		Mark
1 (a)	**AO3 (4 marks)**	
(i)	Award 1 mark the calculation of the **mean** number of deaths recorded of **98.8.** Accept **99** but reject **98.** Note: If the candidate has written the correct answer of 98.8 in their workings but rounded up incorrectly in the answer space 'Mean.....', then accept the correct working result.	**(1)**
(ii)	Award 1 mark for the calculation of the **median** number of deaths recorded of **11**. Accept correct working.	**(1)**
(iii)	Award 1 mark for the two quartiles (**3** and **156**). Award 1 mark for the accurate calculation of the interquartile range of **153**. Allow 1 mark for the correct use of the mathematical formula for interquartile range but if rounding is incorrect they are limited to 1 mark.	**(2)**

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**

Question number	Indicative content
	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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Tectonic hazards have varied impacts measured in terms of social, economic and environmental costs. • Strategies to modify the impact of tectonic hazards include land-use zoning, hazard–resistant building design and engineering defences as well as diversion of lava flows. • Strategies to modify vulnerability and resilience include hi-tech monitoring, prediction, education, community preparedness and adaptation. • Strategies to modify loss include emergency, short and longer term aid and insurance ***and*** the actions of affected communities themselves. **AO2** • Effectiveness might be measured in terms of relatively low numbers of deaths and injuries and/or relatively low economic losses. • A key factor in determining the effectiveness of some strategies is the magnitude of the event. 1 in 1,000 year events are hard to manage given their scale. • Another key factor is the location of the tectonic hazard event. Remote areas are often difficult to reach making emergency aid strategies less effective. • The Tohoku 2011 earthquake and subsequent tsunami had a very high magnitude leading to the loss of over 20,000 lives. • The level of development is also a key factor as it influences the affordability of strategies such as land-use zoning, hazard – resistant design and engineering defences. • The frequency of the events is also a key factor as the high frequency of tsunami events in the Pacific Ocean led to effective prediction using the PTWC based in Hawaii. • Rare events are likely to be unpredictable and thus difficult to manage (e.g. Sichuan in 2008). • Weak governance and levels of corruption are also key factors in ensuring effective management as building codes must be inspected and checked regularly for such a strategy to work. • Governance can be weak in both developed and developing countries. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–4**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding of geographical information/ideas, making limited logical connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce an interpretation with limited relevance and/or support. (AO2) • Applies knowledge and understanding of geographical information/ideas to make unsupported or generic judgements about the significance of few factors, leading to an argument is unbalanced or lacks coherence. (AO2)
Level 2	**5-8**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding of geographical information/ideas logically, making some relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce a partial but coherent interpretation that is mostly relevant and supported by evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to make judgements about the significance of some factors, to produce an argument that may be unbalanced or partially coherent. (AO2)
Level 3	**9-12**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding of geographical information/ideas logically, making relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce a full and coherent interpretation that is relevant and supported by evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to make supported judgements about the

Level	Mark	Descriptor
		significance of factors throughout the response, leading to a balanced and coherent argument. (AO2)

Question number	Answer
2(a)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Glaciers alter landscapes through a number of distinctive processes including erosion, entrainment, transport and deposition. • Glacial erosional processes include abrasion, quarrying, plucking, crushing and basal melting, combined with freeze thaw and mass movement. • These processes lead to the formation of distinctive landforms in high altitude glacial landscapes (e.g. cirques/corries, arêtes, pyramidal peaks). • Periglacial processes will also be significant in creating distinctive landscapes in high-altitude relict glacial regions. **AO2** • The original pre-glacial landscape is unrelated to glaciation. • The development of this landscape is partly but not uniquely a consequence of glacial processes. The role of weathering and mass movement will have been significant throughout. • Figure 2a shows an upland (relict) glaciated cirque landscape with a steep back wall, an over deepened bowl and a raised lip in the foreground formed in part by glacial processes. • In the background there are possible arêtes that might identify a pyramidal peak. The possible arêtes and pyramidal peaks are created by the combination of several cirques eroding backwards towards each other. • Part of the back wall appears to have a vegetated talus scree slope with the presence of a small contemporary area of scree created by freeze thaw weathering.

	• This is a relict glacial landscape which will have been modified since the last glacial advance by post-glacial processes such as weathering and mass movement. • These features have been created by the erosional process of abrasion, quarrying and plucking where the ice has flowed rotationally within the developing cirque, with plucking at the back wall of the cirque and quarrying occurring in the bowl and abrasion on the lip. Indeed some might argue that there are striations visible at the lip of the cirque. • The scree slope, however, is created by freeze-thaw weathering and is the disintegration of the exposed rock on the summit of the mountains. • Human influences are possible both through tourism and agriculture (there is a fence and style in the foreground). • Hummocky ground is likely to be related to erosional processes but deposition might also be inferred. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated or generic elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding to geographical information inconsistently. Connections/relationships between stimulus material and the question may be irrelevant. (AO2)
Level 2	**3–4**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding to geographical information to find some relevant connections/relationships between stimulus material and the question. (AO2)
Level 3	**5–6**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding to geographical information logically to find fully relevant connections/relationships between stimulus material and the question. (AO2)

Question number	Answer
2(b)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Glacial deposition includes the formation of ice contact depositional features (medial, lateral, recessional and terminal moraines and drumlins). • Distinctive landscapes are associated with glacial deposition. • The processes of lodgement and ablation will create depositional landscapes. • Glacial meltwater will both create distinctive landforms but also modify pre-existing glacial landforms/landscapes. **AO2** • The original pre-glacial upland landscape in unrelated to glacial processes. • Its subsequent modification involves a combination of processes, glacial, fluvioglacial, periglacial and sub-aerial weathering and mass movement. • Figure 2b shows hummocky ground set in a glaciated valley with a small (misfit) river prominent in the foreground. • The landscape is largely created by the transportation of either eroded or weathered material either through supra-, en- and sub- glacial processes. • Subsequent post-glacial deposition of material into the glaciated valley by the glacier becoming overburdened with material, or ice velocity reduces, or ablation increases. • Figure 2b might show a series of terminal moraines that have been deposited concurrently due to the rapid melting of stagnant ice. • Figure 2b might show a series of recessional moraines formed by an actively retreating glacier within the valley.

	• Figure 2b might show drumlin type features or push moraines caused by the re-advance of ice and subsequent deformation of pre-existing till. • These might be fluvioglacial kames or kame terraces. • Accept that they might be moraines that were the result of a re-advancing glacier overriding and partially deforming pre-existing debris into a crude type of fluted moraine. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated or generic elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding to geographical information inconsistently. Connections/relationships between stimulus material and the question may be irrelevant. (AO2)
Level 2	**3–4**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding to geographical information to find some relevant connections/relationships between stimulus material and the question. (AO2)
Level 3	**5–6**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding to geographical information logically to find fully relevant connections/relationships between stimulus material and the question. (AO2)

Question number	Answer
2 (c)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • There is a wide variety of glaciated landscapes, both active and relict. • Differences in management may be a consequence if differences in their cultural value. • Another key reason is that many of these areas have multiple economic uses and conceivably therefore one landscape such as Yosemite Valley will require a variety of management approaches such as total protection through to sustainable management. • There are a variety of stakeholders such as conservationists, local and regional government, global organisations and NGOs • Different players will have different agendas for the use and conservation of these areas and so as a result a range of approaches are required to ensure that most of the stakeholder's requirements are met. • There is seldom a consensus concerning the balance between conservation and exploitation e.g. Antarctica. • Environmental sensitivity is also a key reason for the range of approaches being adopted. Areas which have a high environmental value such as SSSI and National Nature Reserves often also require a different approach as strategies. • A range is required because legislative frameworks are used to both protect some landscapes whilst others need conservation. • Significant differences may occur because if differences in scale from local to global. • Successful management posed by climate warming require not only coordinated approaches at global, national and local scale but also require both adaptation and mitigation and so there is a need for a variety of management approaches.

	Accept any other appropriate response.

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Understanding addresses a narrow range of geographical ideas, which lack detail. (AO1)
Level 2	**3–5**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Understanding addresses a range of geographical ideas, which are not fully detailed and/or developed. (AO1)
Level 3	**6–8**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Understanding addresses a broad range of geographical ideas, which are detailed and fully developed. (AO1)

Question number	Answer
2(d)	**AO1 (5 marks)/AO2 (15 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. • Level 4 AO1 performance: 4–5 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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Different factors explain rates of glacial movement and variations in rates. • Glacial mass balance system and the relationship between accumulation and ablation in the maintenance of equilibrium. • Polar and temperate glaciers have different rates of movement because of different temperatures of ice. • There are different processes that are important in the movement of glaciers (basal slip, regelation creep, internal deformation). • A number of factors control the rate of movement (altitude, slope, lithology, size and variations in mass balance) with both positive and negative feedback in the system. • The rate of glacier movement varies from time to time but also form place to place on and within the glacier. **AO2** • Warm ice moves faster than cold ice because there is basal sliding and bed deformation taking place whereas cold ice can only move through internal deformation processes.

Question number	Answer
	• Ice thickness is the key element to explain the role of mass balance – thick ice moves faster than thin ice is all other factors are equal. • The mass balance of a glacier is vital in determining the rate of movement through both the equilibrium line as well as at the snout as when ablation exceeds accumulation the mass balance is said to be negative and the equilibrium line will retreat as well as the position of the snout. • Retreat and speed of ice are easily confused. Retreating glaciers are still obeying gravity. • If accumulation exceeds ablation the mass balance is said to be positive and so the equilibrium line advances as does the snout. • The greater the variations in the mass balance of the glacier the greater the rate of movement through both the equilibrium line as well as the snout. In particular the greater the rate of accumulation the greater the rate of movement of ice through the equilibrium line and the greater the advance of the glacier. • Local conditions determine the amount of meltwater such as altitude and rock type will also affect the amount of basal meltwater and so the rate of movement. • Slope is also a vital factor as the steeper areas of the glacier –will increase the rate of movement as opposed to the flatter areas in lowland areas. • The rate of movement is may be determined by whether the glacier exits to the sea or to land. Where glaciers exits to the sea with deep water a positive feedback loop is created that affect the mass balance of the glacier leading to an accelerated retreat. • The rate of glacial movement for glaciers exiting into the sea is not only determined by the topography of the coastal basin. The rate is also determined by the development or lack of ice mélange. Glaciers such as the Lambert Glacier in Antarctica which exit into a narrow inlet (Amery ice shelf) will see increased rates of movement as climate change will increase the melting of this ice shelf leading to less mélange and so a faster rate of 600m/year. • Climate change can also affect the rate of movement. As air temperatures rise there are greater rates of glacial thinning due to ablation and as a result glaciers at high latitudes where there is accelerated climate change such as Kahiltna (62^{o}N) and even at altitudes varying from 3150m to the snout at 1500m have experienced rapid rates of 130m/year. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–5**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding of geographical ideas, making limited and rarely logical connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce an interpretation with limited coherence and support from evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce an unsupported or generic conclusion, drawn from an argument that is unbalanced or lacks coherence. (AO2)
Level 2	**6–10**	• Demonstrates geographical knowledge and understanding, which is occasionally relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding of geographical information/ideas with limited but logical connections/relationships. (AO2) • Applies knowledge and understanding of geographical ideas in order to produce a partial interpretation that is supported by some evidence but has limited coherence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a conclusion, partially supported by an unbalanced argument with limited coherence. (AO2)
Level 3	**11–15**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and accurate. (AO1) • Applies knowledge and understanding of geographical information/ideas to find some logical and relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical ideas in order to produce a partial but coherent interpretation that is supported by some evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a conclusion, largely supported by an argument that may be unbalanced or partially coherent. (AO2)
Level 4	**16–20**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding of geographical information/ideas to find fully logical and relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce a full and coherent interpretation that is supported by evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a rational, substantiated conclusion, fully supported by a balanced argument that is drawn together coherently. (AO2)

Question number	Answer
3(a)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Erosional processes (hydraulic action, corrosion, abrasion, attrition) create 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 erosion rates and also on the formation of cliff profiles and the occurrence of micro-features, e.g. caves. • Differential erosion of alternating strata in cliffs (permeable/impermeable, resistant/less resistant) produces complex cliff profiles. • Weathering and mass movement are significant processes in the development of coastal landscapes. **AO2** • Figure 3a shows a coastal landscape with a variety of landforms including cliffs, notches, mass movement and a wave cut platform. • The cliff has a well-developed wave cut notch. • The cliff profile shows lower level evidence of erosion largely explained by differences in wave energy and (perhaps) rock resistance. There is also a large wave cut platform. • There is very little direct evidence of deposition from the photograph. • Marine processes of erosion are therefore dominant here with a high erosion rate evidenced by the large wave cut platform. • There are also likely to be destructive waves as evidenced by the lack of sediment on the beach. • Vertical and sub-vertical cliffs are associated with more resistant material.

	• Geological structure of the resistant rock with a well-developed joints and bedding planes encourages marine erosional processes such as cavitation creating the caves visible in the photograph. • Sub aerial processes (weathering and mass movement) have affected the coastal landscape, particularly the weaker unconsolidated material at the top of the cliff profile and possibly the wave cut platform. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated or generic elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding to geographical information inconsistently. Connections/relationships between stimulus material and the question may be irrelevant. (AO2)
Level 2	**3–4**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding to geographical information to find some relevant connections/relationships between stimulus material and the question. (AO2)
Level 3	**5–6**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding to geographical information logically to find fully relevant connections/relationships between stimulus material and the question. (AO2)

Question number	Answer
3(b)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Coastal plain landscapes (sandy and estuarine coasts) are found near areas of low relief and result from supply of sediment from different terrestrial and offshore sources, often in a low-energy environment. • Transportation and deposition processes produce distinctive coastal landforms (beaches, recurved and double spits, offshore bars, barrier beaches and bars, tombolo's and cuspate forelands), which can be stabilised by plant succession. • Vegetation is important in stabilising sandy coastlines through dune successional development on sandy coastlines and salt marsh successional development in estuarine areas. • Human actions will affect the development of these landscapes both through negative and positive actions. **AO2** • Figure 3b shows a coastal plain landscape with a sandy beach with vegetation succession inland. • The sandy beach could have been developed firstly through the process of longshore drift of eroded material with subsequent deposition possibly through the process of settlement in a low energy environment through the action of constructive waves. • A possible view is that this is an area of a large tidal range where sand dries out and then through aeolian processes such as saltation sand is driven on to land by on shore winds. • Figure 3b shows progressively dense vegetation moving inland suggesting a spatial succession.

	• The development of a psammosere succession can be inferred. • Pioneer species such as sea twitch/sea couch and colonising species such as marram grass/heather/gorse stabilise the sand through the binding action of the roots anchoring the sand into a fixed position. • The marram grass/heather then further develops the landscape by trapping wind-blown sand and so increasing the height of the coastal plain above the mean high tide height. • The blowout is likely to have been created through human action of trampling which creates the conditions where wind flow is increased by up to 2 times the proximate beach level. • Human action or inaction may have a role to play in the development of the beach. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated or generic elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding to geographical information inconsistently. Connections/relationships between stimulus material and the question may be irrelevant. (AO2)
Level 2	**3–4**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding to geographical information to find some relevant connections/relationships between stimulus material and the question. (AO2)
Level 3	**5–6**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding to geographical information logically to find fully relevant connections/relationships between stimulus material and the question. (AO2)

Question number	Answer
3(c)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1:** • The physical risks to coastlines are rapid coastal erosion and flood risk. These are managed by a range of both policies and strategies due to a variety of reasons. • Cost and benefits are the main drivers. Some coastlines are more (economically) valuable than others. • Differences in land value is a key reason why a range of approaches are adopted. Areas with high value installations such as the Easington Gas terminal on the Holderness coast are protected by a hold the line policy whilst other adjacent areas of lower value farmland have a policy of no active intervention. • There are many stakeholders (players) with competing interests and different views of what might constitute successful management. • Engineering feasibility is another reason for a range of approaches being adopted. In some areas it is not possible to adopt a hard engineering solution to physical risks such as rapid coastal erosion due to marine factors such as dominant prevailing winds or geological factors such as weak rock. • Areas which are extremely low lying may be obliged to adopt a policy of strategic realignment as the combination of the existing isostatic downwarping and predicted sea level rise leave many engineering solutions either overly expensive or technically unfeasible such as the strategic realignment that has been adopted at Medmerry beach near Selsey. • Throwing good money after bad in regions with long-term prospects of glacio-isostatic sea-level rise. • Environmental sensitivity is also a key reason for the range of approaches being adopted. Areas which have a high environmental value such as SSSI

	and National Nature Reserves often also require a different approach as strategies such as hard engineering may be deleterious to the biodiversity of the area. • Social reasons such as the use of the coast by various stakeholders (players) are another reason why a variety of approaches to manage the coast. In areas of bucket and spade tourism 'softer defences' such as wooden groynes are more likely to be used than 'harder' defences such as rock groynes and offshore breakwaters due to the risk that such defences pose. • Political reasons may also be a key reason why a range of management approaches are adopted. In the Thames estuary the immense political importance of not allowing the centre of London nor the City of London to flood was a key reason for the development of the Thames barrier. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Understanding addresses a narrow range of geographical ideas, which lack detail. (AO1)
Level 2	**3–5**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Understanding addresses a range of geographical ideas, which are not fully detailed and/or developed. (AO1)
Level 3	**6–8**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Understanding addresses a broad range of geographical ideas, which are detailed and fully developed. (AO1)

Question number	Answer
3(d)	**AO1 (5 marks)/AO2 (15 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. Level 4 AO1 performance: 4–5 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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Global sea level rises increases risk (Bangladesh or the Maldives). • Local factors increase flood risk on some low-lying and estuarine coasts (height, degree of subsidence, vegetation removal). • Storm surge events (depressions, tropical cyclones) can cause severe coastal flooding. • Climate change may increase coastal flood risk (frequency and magnitude of storms, sea level rise). • Rising population in coastal regions increases risk significantly. • Costs of protecting some coasts may become unsupportable especially in regions/locations with long term negative isostasy. • Sea levels have risen by over 20cm in the last 100 years and is much greater than the rate of sea level rise during the past 3,000 years. Coastal flood risk is therefore rapidly increasing globally. **AO2** • Sea level rise is thought to be increasing in the future by as much as 2m in the next 100 years and many estimates put the risk higher than that.

Question number	Answer
	• A key cause of rising flood risks is eustatic changes where global warming is causing sea temperatures to rise and so the sea expands and so causes sea levels to rise and so increasing flood risk in areas such as the Pacific Islands. • There is also isostatic downwarping. This is caused by the rebound of glaciated land relative to the sea. In areas of the south of England flood risk is increasing as a result of the south of England sinking into the sea so increasing flood risk whilst Scotland rebounds upwards. • Downwarping can occur due to the accretion (build up) of sediment brought down by rivers that create the deltas such as in Bangladesh thereby increasing flood risk. • Tectonic activity can change the relative sea level with areas in tectonically active areas undergoing displacement and so an increased flood risk. • Rising sea levels are not the only physical factor causing flood risk to increase. Climate change will put more energy in to the atmosphere and so the conditions for a tropical storm to start (26.5^{o}C) will occur more often and so there will be more hurricanes increasing coastal flood risk. • Higher sea surface temperatures will cause the tropical storms to have lower pressure and so have faster wind speeds and so increase the flood risk of areas affected by such storms. • More energy in the atmosphere will mean that depressional storms that hit the UK will have lower pressure and so stronger wind speeds as well further increasing flood risk. • Sea level rise is not the only cause of increased flood risk. Human factors can also cause increased flood risk. Increased populations in settlements at vulnerable coastlines is also causing an increased flood risk. • Human intervention can increase flood risk in some places by reducing it in others. • In other areas, such as the Maldives, the flood risk has developed due to the removal of mangrove swamps. These are vital natural barriers against flooding as they trap sediment and so raise the level of the beach front. Without the protection of mangrove swamps there is little to stop rising sea levels caused by eustatic change and so removal of vegetation increases flood risk. • A lack of resources also can increase flood risk. Countries such as Bangladesh are relatively poor and cannot afford defences such as sea walls and flood barriers that other richer countries can afford. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–5**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding of geographical ideas, making limited and rarely logical connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce an interpretation with limited coherence and support from evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce an unsupported or generic conclusion, drawn from an argument that is unbalanced or lacks coherence. (AO2)
Level 2	**6–10**	• Demonstrates geographical knowledge and understanding, which is occasionally relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding of geographical information/ideas with limited but logical connections/relationships. (AO2) • Applies knowledge and understanding of geographical ideas in order to produce a partial interpretation that is supported by some evidence but has limited coherence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a conclusion, partially supported by an unbalanced argument with limited coherence. (AO2)
Level 3	**11–15**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and accurate. (AO1) • Applies knowledge and understanding of geographical information/ideas to find some logical and relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical ideas in order to produce a partial but coherent interpretation that is supported by some evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a conclusion, largely supported by an argument that may be unbalanced or partially coherent. (AO2)
Level 4	**16–20**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding of geographical information/ideas to find fully logical and relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce a full and coherent interpretation that is supported by evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a rational, substantiated conclusion, fully supported by a balanced argument that is drawn together coherently. (AO2)

Question number	Answer	Mark
4(a)	**AO1 (2 marks)/AO2 (1 mark)** Award **1** mark for analysing the resource to identify that there was an increase in biofuel production in Brazil and a further **2** marks for expansion on the possible impacts up to a maximum of 3 marks. Possible answers may include: • Biofuel production in Brazil has increased (1) leading to the loss of trees (1) and so reducing carbon sequestration (1). • The increase in biofuels from 10.5 billion litres to 34.7 billion litres (1) has meant more land has to be cleared for cattle ranching (1) and so increases methane production (1). • The increase of biofuel production in Brazil (1) means deforestation has increased to provide land for biofuel production (1) therefore there is more CO_2 in the atmosphere (1). **Accept any other appropriate response.**	**(3)**

Question number	Answer
4(b)	**AO1 (6 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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • Developing countries have an energy mix where the majority of energy comes from biomass and waste (wood, dung) which is cheap and often free. • Developing countries will also often use natural resources such as firewood directly for cooking. There is limited fossil fuel use – oil for transport, coal for power stations in some of the relatively wealthier developing countries. • Emerging countries will have a growth of mass transport and mass car ownership so oil use rises. There is a shift towards gas as technology develops and eventually the richer industrialising countries, such as China develop nuclear power. • Some emerging economies such as China will start to increase their use of renewables whilst others will have lower use as economic development overrides concern for the environment. • In the developed countries oil remains high due to its importance as a transport fuel yet at the same time coal declines due to pollution concerns and replacement with cheaper gas. • In addition in some developed countries there is nuclear power as this requires sophisticated and expensive technology. • There is also a rise in clean energy sources rise due to environmental concerns and a growing sustainability agenda further encouraging renewables. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate. (AO1) • Understanding addresses a narrow range of geographical ideas. (AO1) • Understanding of geographical ideas lacks detail. (AO1)
Level 2	**3–4**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Understanding addresses a range of geographical ideas. (AO1) • Understanding of geographical ideas is not fully detailed and/or developed. (AO1)
Level 3	**5–6**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Understanding addresses a broad range of geographical ideas. (AO1) • Understanding of the geographical ideas is detailed and fully developed. (AO1)

Question number	Answer
4(c)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO 1** • Permafrost covers some 25% of the exposed land cover in the Northern Hemisphere and contains 1672Gtc of carbon which is not usually considered in carbon cycle models. • There is an uncertainty over how much the permafrost has warmed with estimates varying between 0.5^{o}C and 2^{o}C as a result of differences in study regions giving different estimates. • There are also uncertainties over future changes with estimates varying from 2.8^{o}C to 7.8^{o}C mainly as a result of the uncertainties of the rate of industrialisation in HMHD. • There are also uncertainties over the spatial loss of permafrost with estimates varying from 7% to 88% as there are uncertainties as we don't know the extent to which global treaties such as the Paris agreement will reduce emissions. • There are also uncertainties over the increases in the depth of the active layer with estimates varying from an increase of 40% to 100%. The greater the increase the greater the emissions of carbon as there are uncertainties as we are unsure of the feedback mechanisms between future changes in climate and carbon release from permafrost. • There are also uncertainties over the role of talik formation, thermokarst development and the rate of river and coastal erosion all of which will cause variations in carbon emissions from permafrost areas. • The burning, draining and degrading of peatlands emits more than one tenth of the global emissions released from burning fossil fuels. • There are also uncertainties over the rate of restoration of peatlands which will reduce carbon emissions from these sources. Degraded peatlands can be restored.

	• Crucially it is uncertain the extent to which the drainage of peatlands will be reduced. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–2**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Understanding addresses a narrow range of geographical ideas, which lack detail. (AO1)
Level 2	**3–5**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Understanding addresses a range of geographical ideas, which are not fully detailed and/or developed. (AO1)
Level 3	**6–8**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Understanding addresses a broad range of geographical ideas, which are detailed and fully developed. (AO1)

Question number	Answer
4(d)	**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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • The growing mismatch between water supply and demand has led to a global pattern of water stress (below 1,700 m^3 per person). • The causes are physical such as climate variability and salt water encroachment at coast. • The finite water resource faces pressure from rising demand (increasing population, improving living standards, industrialisation and agriculture), which is increasingly serious in some locations. • The causes are human such as over abstraction from rivers, lakes and groundwater aquifers, water contamination from agriculture, industrial water pollution. **AO2** • A physical factor is the climate as some areas will have water stress as people are living in arid areas such as Saudi Arabia will have very high levels of projected water stress as they are underneath the descending arm of the Hadley Cell. • Semi-arid areas will have a high level of projected water stress such as the US and Mexico (High) as well as Australia.

Question number	Answer
	• Areas on the equator such as Nigeria will continue to have a high precipitation level and so a low level of projected water stress. • The distribution of precipitation over the year will also cause projected high level of water stress. Areas with ephemeral rivers where rivers only flow in winter months leading to water shortages in the summer such as Tunisia. • The geology of the country also plays a role as countries such as the UK which has many aquifers such as the South Downs will have a lower projected water stress than similar climatic areas such as Belgium which do not have the same ground water supplies. • Climate change is likely to reduce precipitation levels - which may be making the water situation worse in some areas such as Pakistan which is projected to have a very high level of water stress. • Another key physical factor are where there are transboundary sources where some area which have a projected very high water stress are areas such as Syria and Israel which rely upon transboundary water sources. • There are also human factor that influence the pattern of projected water stress. Areas with rapid population growth such as India have a high level of projected water stress when the development of water supplies does not match the increase in population. • Areas that are undergoing rapid economic growth such as China have a high projected level of water stress industries require more water and as the wealth of the population rises, the demand for domestic water also increases. • Overuse due to high levels of economic wealth can also cause high levels of projected water stress as in wealthy countries, the demand for domestic use is rising as is demand for agriculture are people want more expensive 'succulent fruit and vegetables. As a result water stress in Southern Europe is increasing such as in Spain. • The map clearly shows that although human factors do play a significant role in some areas where there is either rapid population growth or economic development, physical factors play perhaps the more significant role as areas with high levels of precipitation are still projected to have low levels of water stress regardless of economic development or population growth. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–4**	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate. (AO1) • Applies knowledge and understanding to geographical information/ideas, making limited logical connections/relationships. (AO2) • Applies knowledge and understanding to geographical information/ideas to produce an interpretation that is not relevant and/or supported by evidence. (AO2) • Applies knowledge and understanding to geographical information/ideas to produce an unbalanced argument that lacks coherence and makes judgements that are generic and/or unsupported by evidence. (AO2)
Level 2	**5–8**	• Demonstrates geographical knowledge and understanding, which is mostly relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding to geographical information/ideas logically, making some relevant connections/relationships. (AO2) • Applies knowledge and understanding to geographical information/ideas to produce a partial but coherent interpretation that is mostly relevant and supported by evidence. (AO2) • Applies knowledge and understanding to geographical information/ideas to produce an unbalanced, partially-supported argument that is drawn together with some coherence in order to make judgements. (AO2)
Level 3	**9–12**	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding to geographical information/ideas logically, making relevant connections/relationships. (AO2) • Applies knowledge and understanding to geographical information/ideas to produce a full and coherent interpretation that is relevant and supported by evidence. (AO2) • Applies knowledge and understanding to geographical information/ideas to produce a balanced, fully-supported argument that is drawn together coherently in order to make rational judgements. (AO2)

Question number	Answer
4(e)	**AO1 (5 marks)/AO2 (15 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. • Level 4 AO1 performance: 4–5 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. Please remember that the descriptors provide guidance as to the appropriate level. Bullet points covering the indicative content do not translate directly into marks. Relevant points may include: **AO1** • The pros and cons of the techno-fix of hard engineering schemes to include water transfers, mega dams and desalination plants. • Large scale water management projects can also include national projects at a household level such as the provision of grey water systems or pumpkin tanks. • Integrated drainage basin management for large rivers are always controversial. • The potential for conflicts to occur between users within a country, and internationally over local and trans-boundary water sources • Water frameworks (United Nations Economic Commission for Europe (UNECE), Water Convention, Helsinki, and the Water Framework Directive and Hydropower, Berlin). **AO2** • An advantage of the development of large scale water management schemes such as mega dams is that they reduce the flood risk and so allow the river to be used as transport artery. This can also aid regional development as is the case in the development of Wuhan on the Yangtze

	which has developed partly as the result of the Three Gorges dam regulating the flow of the river. • Large scale water management schemes can also displace large numbers of residents (1.2m in the case of the Three Gorges dam) due to the creation of reservoirs therefore creating conflict between the local people and (often) other users in urban areas. • Large scale water management schemes also can creates HEP which helps develop the region and country and even, in the case of the Gibe III dam create a source of foreign revenue as the electricity can be exported to neighbouring (richer) countries. • Such schemes also often disrupt the hydrology of rivers and there are often irreversible changes downstream resulting in other users losing access to ancient fishing grounds such as in Ethiopia as well as damage to ecosystems such as the loss of the river Yangtze Dolphin. • Another advantage of large scale water management schemes such as mega dams is that they provide water for agriculture, industry and people. Schemes such as in the Colorado Drainage basin provide water for millions of people in cities such as Phoenix and Las Vegas as well as irrigating large areas of crops in the Imperial Valley. • Water transfer schemes can also provide water for irrigation creating both regional and national advantages such as the Snowy mountain scheme in Australia and the water transfers associated with the Aral Sea in Uzbekistan. • Yet these schemes often alter the water quality and cause conflicts with downstream users who can no longer utilise the resource such as those farmers on the River Colorado in Mexico as well as destroying ecosystems such as the delta of the river Colorado. • Water treaties can reduce some of these problems caused by the development of large scale water management schemes. The IWBC signed between the US and Mexico has reduced the problems caused by the developments on the river Colorado and the Mekong River Commission has also reduced the problems found in the lower basin of the Mekong River. • Water is a finite resource and it is therefore very likely that in almost all cases large scale water management schemes will create both advantages and cause problems. • Problems can be reduced but not eliminated through the use of water treaties and frameworks but these too are at the mercy of asymmetrical power relationships. In terms of the environment, however, it is likely that there are more problems caused as the purpose of the large scale projects is to provide water for people rather than enhance the environment. **Accept any other appropriate response.**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–5	• Demonstrates isolated elements of geographical knowledge and understanding, some of which may be inaccurate or irrelevant. (AO1) • Applies knowledge and understanding of geographical information/ideas, making limited and rarely logical connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce an interpretation with limited relevance and/or support. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce an unsupported or generic conclusion, drawn from an argument that is unbalanced or lacks coherence. (AO2)
Level 2	6-10	• Demonstrates geographical knowledge and understanding, which is occasionally relevant and may include some inaccuracies. (AO1) • Applies knowledge and understanding of geographical information/ideas with limited but logical connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce a partial interpretation that is supported by some evidence but has limited coherence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a conclusion, partially supported by an unbalanced argument with limited coherence. (AO2)
Level 3	11-15	• Demonstrates geographical knowledge and understanding, which is mostly relevant and accurate. (AO1) • Applies knowledge and understanding of geographical information/ideas to find some logical and relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce a partial but coherent interpretation that is supported by some evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a conclusion, largely supported by an argument that may be unbalanced or partially coherent. (AO2)
Level 4	16-20	• Demonstrates accurate and relevant geographical knowledge and understanding throughout. (AO1) • Applies knowledge and understanding of geographical information/ideas to find fully logical and relevant connections/relationships. (AO2) • Applies knowledge and understanding of geographical information/ideas to produce a full and coherent interpretation that is supported by evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to come to a rational, substantiated conclusion, fully supported by a balanced argument that is drawn together coherently. (AO2)

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