Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCE in Geography (8GE01)
Unit 1: Dynamic Landscapes

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General marking guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark scheme – not according to their perception of where the grade boundaries may lie.
- 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/indicative content will not be exhaustive.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, a senior examiner must be consulted before a mark is given.
- Crossed-out work should be marked unless the candidate has replaced it with an alternative response.

Question number	Answer	Mark
1(a)	**AO1 (1 mark)** Award **1** mark for the correctly identified element: • C: Subduction	(1)

Question number	Answer	Mark
1(b)(i)	**AO3 (2 marks)** Award **1** mark for each correctly identified **comparison** between the earthquake in Japan and Ecuador. • The magnitude of the EQ was **higher** in Ecuador than Japan ❶ • Number of deaths in Ecuador was much **higher** than Japan ❶ • Number of injuries in Ecuador was much **higher** than Japan ❶ • **Less** buildings in Japan were destroyed ❶ Accept any other correct comparison based on figure 1. Do not accept statements that do not use comparative language.	(2)

Question number	Answer	Mark
1(b)(ii)	**AO1 (2 marks)/AO2 (1 mark)** Award **1** mark for analysing the resource to identify a way that Japan has used a strategy to reduce EQ impact, and a further **2** marks for justifying the possible reason, for example: • Well organised drills / education prepares people ❶ so that they know how what to do / evacuate ❶ and deaths / injuries are lowered as a result ❶ • Earthquake proof design / Buildings designed better ❶ so that they withstand earthquakes and don't collapse ❶ because energy is absorbed by cross bracing / money is spent on earthquake sciences and engineering research / government regulations require better design in Japan ❶ • Early warning systems / broadcast systems ❶ warn people / alert / start evacuations etc • Good medical care reduced fatalities ❶ because of good infrastructure / quick response to those injured ❶ and preventing serious injuries from becoming life threatening ❶ • Accept any other appropriate response based on figure 1.	(3)

Question number	Answer	Mark
1(c)	**AO1 (4 marks)** For each hazard, award **1** mark for identifying a secondary hazard caused by an earthquake and a further **1** mark for explaining it. For example: • Tsunami ❶ when earthquakes displace the water column creating a bulge of water / waves which ripple outwards ❶ • Landslides / slope instability ❶ when ground shaking dislodges / destabilises slope material causing it to slide / topple ❶ • Liquefaction ❶ when ground shaking causes sediment to behave like a liquid / solid surface start to slide or flow ❶ • Submarine landslides ❶ which might then create a tsunami ❶ • Aftershocks ❶ because the initial earthquake put stress on surrounding faults / crust ❶ • Fires ❶ because the earthquake ruptured gas/electricity lines ❶ • Building collapse ❶ because the ground shakes / landslides ❶ • Spread of disease ❶ because of a lack of sanitation / living in close proximity in rescue centres ❶ • Mantle fracturing ❶ Accept any other appropriate response. Do not accept reference to 'ground shaking' unless in the context of explaining the secondary hazard. Cannot have the same extension twice.	**(4)**

Question number	Answer
1(d)	**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. Relevant points may include: • Lava flow are streams of molten rock that flows from a volcanic event, the viscosity and speed of which depends on the type of volcano eruption • Pyroclastic flow / Nuee ardentes are caused by a very explosive eruption when the eruption column itself collapses and can't continue to rise; it might also happen when material 'boils over' from an eruption vent; alternatively when lava domes collapse because of gravity • Tephra / ash are tiny particles of rock and natural glass blasted into the air by a volcanic eruption; they can then be transported by wind thousands of miles; electrostatic charging created by the upward movement of ash can help trigger thunderstorms, which in turn can trigger lahars • Gas eruptions occur when magma contains dissolved gasses and these are released from the liquid magma as it reaches the surface (pressure decrease), and then released into the atmosphere. • Lahars are caused by rain mixing with either ash on the steep side of a volcano creating a great mudflow (e.g. Java), or ash mixing with rain • Jokulhlaups occur when the volcano beneath an ice cap erupts, and large amounts of ice above it melts, subsequently bursting out from the ice cap and surging across the outwash plain surrounding the ice cap. • Volcanoes can, on occasions trigger a tsunami • On some occasions, volcanoes can causes earthquakes, when magma puts pressure on rock until they crack.

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	**3–4**	• 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	**5–6**	• 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**
1(e)	**AO1 (3 marks)/AO2 (9 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Responses that demonstrate **only** AO1 without any AO2 should be awarded marks as follows: • Level 1 AO1 performance: 1 mark • Level 2 AO1 performance: 2 marks • Level 3 AO1 performance: 3 marks. **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • Governance means the ability of an organisation / group of people to plan or manage hazard events effectively – e.g. national government might finance emergency care, mandate education strategies. Local governments might organise evacuation strategies. Global governance might co-ordinate a tsunami warning system. • Development means the broad socio-economic status of a country, and whether they recognise the hazard and have sufficient financial status to implement changes on national or local scales. • Scale of tectonic disasters could be measured by the impact on the economy, human life, the environment, and be either quantitative, or spatial (extent). • Tectonic events are caused by plate tectonics and include earthquakes / volcanoes / landslides / tsunamis – a high magnitude event means the impact of the disaster will be higher (e.g. because of greater areal extent) **AO2** • Development and governance help understand disaster impact – e.g. the level of inequality reflects the level of development for some communities – and includes unequal access to education, housing, healthcare, income for some communities.

Question number	Answer
	• If disasters occur in developed countries, there will be less social impact. However, the economic impact might be much higher because of damage to critical infrastructure (e.g. disruption to global trade, movement of people). Poor development and governance is often caused by high population density (high levels of urbanisation) and/or isolation from centre of government • It is easier for developed countries to take action in response to disasters. However, sometimes their actions in response to some hazards (e.g. volcanoes) might have knock-on consequences which are more disruptive (e.g. disruption to global trade because European airspace was closed because of ash). Equally not all developed countries are well governed (e.g. Italy l'Aquilla in 2009) • There are other reasons that determine disasters, e.g. physical geography factors, can determine whether some countries are affected more than others; (e.g. direction of ash fall, tsunami wave propagation) • Unequal development can limit access to some strategies such as insurance / rebuilding, but equally over larger areas with high magnitude, inequality can either matter more, or overwhelm strategies for all groups • Unequal development means disasters can have significant impact on <u>local</u> communities some of which might not be able to access short-term aid, particularly if vulnerable groups cause emergency resources to become stretched. Equally the impact of a disaster could be **so** significant that it triggers a global response, e.g. after the 2004 Asian Tsunami • Serious damage caused by a disaster in the developing world can wipe out entire communities. On the other hand, serious damage can refocus communities to increase their own resilience by constructing buildings using traditional hazard resistant design (e.g. Dharji Dewari buildings in Kashmir) Judgements will be based around whether development and governance are the most important factors understanding why disasters can be bigger, but some might argue that this only explains response; other factors explain the causes of the original event and inability to alter the physical factors that contribute to this. Overall, judgements should be based on reasons for the scale/size of disaster, perhaps by scale / time etc.

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 judgments about the significance of few factors, leading to an argument which 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 judgments 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 judgments about the significance of factors throughout the response, leading to a balanced and coherent argument. (AO2)

Question number	Answer	Mark
2(a)	**AO1 (1 mark)** Award **1** mark for a correctly identified factors that affects glacier movement, for example: • Latitude • altitude • slope • lithology • (Glacial) mass • changes to mass balance (due to precipitation / melting / climate change) • ice temperature / thickness / presence of basal water / cold or warm-based glacier • positive and negative feedback • seasons • earthquake Allow any other reasonable response.	(1)

Question number	Answer	Mark
2(b)(i)	**AO3 (2 marks)** Allow **1** mark for each correct final answer. • Nearer surface reading rate: 28 mm/yr • Nearer base reading: 14 mm/yr Do not accept any other answer.	(2)

Question number	Answer	Mark
2(b)(ii)	**AO1 (2 marks)/AO2 (1 mark)** Award **1** mark for analysing the resource to identify a reason and a further **2** marks for explaining how that reason explains the different rates of movement shown in figure 2, for example: Velocity is higher nearer the surface because • The base of the glacier could be frozen to its bed ❶ , cold based glacier ❶ perhaps because its higher altitude / latitude ❶ • Internal deformation/ weight of the glacier at the base ❶ causes the ice to deform under gravity ❶ which enables ice above the basal layers to move / laminar flow ❶ • Contact between ice and valley floor / sides ❶ means the frictional effects of bedrock become greater ❶ increasing resistance / resistive stresses ❶ Accept any other appropriate response. Do not accept explanations that relate to warm-based glaciers (pressure at base causes melting) – because glacier movement in figure 2 slows with depth.	(3)

Question number	Answer	Mark
2(c)	**AO1 (4 marks)** For each reason, award **1** mark for identifying an erosion process and a further mark explaining how it works, up to a maximum **2** marks each. For example: • Abrasion ❶ when the glacier carries coarse debris at its base ❶ • Quarrying / plucking ❶ removes rock that has been weathered in pre-glacial times ❶ • Pressure release ❶ when glaciers open up joints in the rock ❶ • Crushing ❶ as basal debris carried by the glacier creates grooves in the bedrock surface ❶. Accept any other reasonable response. Do not accept weathering / rock breakdown processes.	(4)

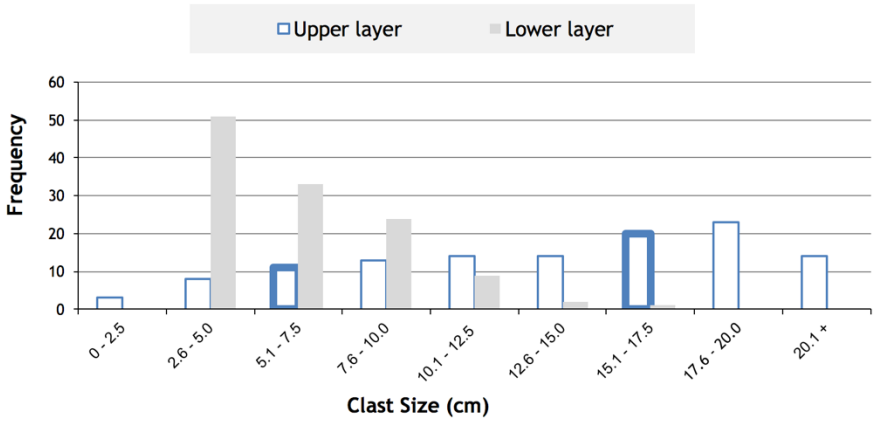
Question number	Answer
2(d)	**AO1 (6 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: • Lowland depositional landscapes are those away from mountains themselves, e.g. within U-shaped valleys, glacial outwash plains, periglacial landscapes. A landscape is a unique combination of processes and landforms. • Glacial depositional landscapes might include different types of till / moraine (e.g. subglacially, terminal and lateral moraines) because perhaps because glaciers have stopped moving / come into contact with surfaces. • When glaciers open out onto a plain, till is deposited as swarms of rounded hummocks (drumlins), the shape of which are streamlined so that their long-axis lie parallel to the ice movement. • Fluviglacial depositional landforms, might include kames (where material is deposited in depressions on the surface) and eskers (where materials was deposited by rivers flowing underneath the ice) • Periglacial environments might include sand dunes and loess, formed by sediment drying in the summer, and being transported by wind to other locations. • Other landscape features might include Erratics are deposited by melting glaciers after being transported hundreds of kilometres, often from regions of different geology. Allow other reasonable explanations.

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	**3–4**	• 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	**5–6**	• 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(e)	**AO1 (3 marks)/AO2 (9 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Responses that demonstrate **only** AO1 without any AO2 should be awarded marks as follows: • Level 1 AO1 performance: 1 mark • Level 2 AO1 performance: 2 marks • Level 3 AO1 performance: 3 marks **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • Glaciated landscapes include both active and relict landscapes that are the by-product of glacial processes, both erosional and depositional. • Sustainable management means long-term solutions or, ensuring the resources of the landscape can be enjoyed by future generations or take into account the interests of all players (social), or can cope with future (unexpected?) challenges, e.g. climate change (environmental), or represent good value for money (economic). • Sustainable management schemes are one of a spectrum of approaches could represent a middle course between full conservation and 'do nothing'. • Stakeholders help conserve and protect landscapes (e.g. Friends of the Lake District) and include conservationists, NGOs (e.g. Greenpeace), scientists (e.g. BAS) local and regional government, and global organisations • Legislative frameworks are another aspect of a spectrum of approaches (e.g. Alpine Convention), as well as comprehensive protection • Threats affecting glaciated landscapes include deforestation / tourism /agriculture / dam construction / infrastructure cause environmental degradation and slope failure **AO2** • Human activity can cause degradation of the landscape and ecology, e.g. soil erosion / landslides / avalanches, equally this, in turn, threatens the viability of agriculture itself, particularly in fragile environments close to the glacial margin • Sustainable management strategies can be an appropriate way to reduce exploitation of the environment (less walkers, fewer dams etc), however they can threaten economic prosperity in remote mountainous landscapes that might depend on exploitation for survival (e.g. the winter ski season), or reducing visual impact of

Question number	Answer
	technology might increase the number of walkers to a renewed wilderness environment • Appropriate actions to manage active environments might involve global action to mitigate against climate change, however in relict areas, more small-scale conservation might be more appropriate. However, care is needed to ensure that direct actions don't reduce resilience, and indirect actions don't alter natural systems • Antarctica's uniqueness requires appropriate response based on internationally agreed values / no resident population. The Treaty + Annexe restricts occupation/use so far - so therefore not so much opportunity for economic use, instead more for research, education but there is increasingly a tourist use. • Sustainable management strategies might include the use of technology, e.g. oil pipelines, satellite imagery, building design, artificial snow cannons), however these still require specialist stakeholders to be appropriate, and some technology might be more intermediate than others (e.g. skidoos, GPS systems in the Nunavut region) • Relying on stakeholders requires compromise, which is difficult to achieve, meaning that glaciated landscapes often are categorised as those that need to be protected, or those that can be exploited. On the other hand, this has driven an agenda to recognise geodiversity as being as important as biodiversity, and would be an appropriate means to make the case for protecting landscapes • Legislative frameworks might be appropriate to help some stakeholders see the environment as sacred / easily disrupted / essential for their future and action is needed to preserve it. On the other hand, frameworks might prevent other groups who depend on glaciated landscapes and see the challenge to 'adapt or die' is made more difficult (the management scheme becomes ineffective)

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 judgments 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 judgments 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 judgments about the significance of factors throughout the response, leading to a balanced and coherent argument. (AO2)

Question number	Answer	Mark
3(a)(i)	**AO3 (1 mark)** Award **1** mark for completing **both** columns to show a frequency of 11 and 20 respectively.  • Accept responses that have not drawn the associated bar but correctly plotted the right line. • Accept responses for upper layer that might seem they are close to 12. Do not accept 10. • Do not accept responses that plot at single data point. • Do not accept bar graph.	**(1)**

Question number	Answer	Mark
3(a)(ii)	**AO3 (2 mark)** Award **1 mark** for each valid reason. • There are two known groups – upper / lower till ❶ • It is possible to select the same proportion of clasts / sediment from each layer ❶ • It is then possible to do a comparison ❶ • There are two subsets (upper / lower) that make up the entire till exposure ❶ • Can reduce bias ❶ Accept reference to proportionately sized datasets. Accept any other reasonable response. Do not accept removes bias.	**(2)**

Question number	Answer	Mark
3(a)(iii)	**AO3 (2 marks)** Award **1 mark** for a valid reason and **1 additional** mark for justification based on the data. • The till is from two different glacial flows ❶ transporting different sized materials / from different source areas / over different periods of time / different distances / different hardness of rock ❶ • One of the layers might be deposited as a result of changed climate ❶ deposited after glacial layer / during warm / interglacial event / seasonal change ❶ Accept any other reasonable response. Allow reference to fluvioglacial on the grounds it could be resorted till on the outwash till in the middle layer. Do not allow references to varve formation.	**(2)**

Question number	Answer	Mark
3(a)(iv)	**AO3 (4 marks)** For each additional technique, award **1** mark for identifying a technique that helps investigation into glacial deposition, and a further **1** mark for explaining why that technique would help with the investigation. • Sediment orientation ❶ to determine the direction of glacial flow ❶ • Lithology study ❶ to determine the origins of glacial material alongside GIS / Geological mapping / iGeology App ❶ • Sediment roundness / Cailleux Roundness ❶ – to determine if any fluvio-glacial sorting had occurred ❶ • Till fabric analysis ❶ how the sediment was transported / source of the material ❶ • Field sketches / annotated photos ❶ to show evidence of the difference in sediment size between the layers ❶. • Chi^2, T-test ❶ to statistically test if there is a difference between the layers ❶ Accept any other appropriate response. Do not accept references to sediment size.	**(4)**

Question number	Answer
3(b)	**AO3 (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. **Indicative content guidance** Content depends on students' choice of enquiry question and the research sources used. Secondary sources might include: • Online sources, e.g. university or expert websites about the location, GIS data sources, newspaper articles, satellite imagery • Other reading might include Geography Review articles, Field Studies Centre backgrounds, • Other map resources might include 1:25,000 and 1:50,000 maps of the, previous field sketches, Geological Maps, including those available as software. Assessment should include the following: • sources of information and ideas should be clearly outlined with some supportive detail about relevance, data about the enquiry location, theoretical frameworks used to consider and plan possible fieldwork techniques. Some candidates might have been provided with baseline data, e.g. from field-studies centre or environmental monitoring networks. • links between sources and the resulting geographical enquiry question should be clear • the value of the sources should be clearly explained with appropriate links to how they help contextualise the geographical ideas being tested • qualifications should be evident about the information's relevance and whether it helped understand or explore the enquiry question, i.e. if it helped plan the fieldwork, write hypotheses or explain the findings of the fieldwork. All judgements are likely to be partial and tentative given the limited range of secondary sources used.

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–3**	• Shows evidence that fieldwork investigation skills used may not have been fully appropriate or effective for the investigation of the geographical questions/issue. (AO3) • Considers the fieldwork investigation process/data/evidence, with limited relevant connections and/or judgements. (AO3) • Argument about the investigation is simplistic and/or generic. (AO3)
Level 2	**4–6**	• Shows evidence that fieldwork investigation skills used were largely appropriate and effective for the investigation of the geographical questions/issue. (AO3) • Critically considers the fieldwork investigation process/data/evidence in order to make some relevant connections and valid judgements. (AO3) • Argument about the investigation may have unbalanced consideration of factors, but is mostly coherent. (AO3)
Level 3	**7–9**	• Shows evidence that fieldwork investigation skills used were appropriate and effective for the investigation of the geographical questions/issue. (AO3) • Critically considers the fieldwork investigation process/data/evidence in order to make relevant connections and judgements that are supported by evidence. (AO3) • Argument about the investigation includes balanced consideration of factors and is fully developed and coherent. (AO3)

Question number	Answer
4	**AO1 (4 marks)/AO2 (12 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 marks **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • The region is a periglacial environment zone, with processes associated with continuous, discontinuous and sporadic permafrost, as well as tectonic (earthquakes). • Tundra is home to unique biodiversity, and helps maintain the global carbon system. • Hazard-resistant engineering design is a solution to the problems of earthquakes and seasonally active layers. • The pipeline helps create oil wealth by transferring oil from Prudhoe Bay to ports in the South as well as the rest of the USA • Glaciated landscapes can be managed in a variety of ways, ranging from total protection to total exploitation. **AO2** • Engineering has helped design a solution that transports oil across Alaska without fragile environments being damaged by tectonic and periglacial processes (figure 4c), but it also helps create wealth for Alaska (figure 4b) • The design above ground helps Caribou continue their migration. However, exploitation on the North Slope, the Caribou migration routes have already been affected (figure 4c) • Engineering solutions help create wealth for local communities in the North Slope by providing jobs, however they also have the potential to ruin traditional lifestyle such as the Gwish'in (Figure 4b) • • The design of the pipeline also helps prevent melting of the permafrost from the heat of the oil, but the pipeline can be responsible for oil spills, that threaten the biodiversity (figure 4a/4b) • There are other solutions that protect the biosphere, including the Arctic National Wildlife Refuge (figure 4a), however total protection prevents the exploitation of 10 billion barrels of oil, which Alaska depends upon. • Engineering solutions are required for buildings to withstand with solifluction / melting of the active layer (exacerbated by climate change)

Question number	Answer
	(figure 4a), however technology facilitates the necessary revenue from oil exports to fund these solutions (figure 4b) • Some candidates might note the melting of permafrost could release methane with an associated positive feedback impact on climate together with the burning of hydrocarbons; although engineering interferes with water/carbon cycles, it also has the potential to help communities adapt to climate change impacts • Wider ranging global solutions might be needed to mitigate climate change emissions • Overall, engineering provides a solution to some environmental challenges in Alaska. However, it also facilitates the growth of the oil industry and thereby creates ecological and social problems for local communities, some of which are irreversible. Total protection would address some of these issues, but prevent much needed revenue and threaten the potential of technology to solve subsequent problems.

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 and rarely logical connections/relationships, 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) • Limited synthesis of geographical ideas from across the course of study. (AO2)
Level 2	**5–8**	• 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 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) • Argument partially synthesises some geographical ideas from across the course of study, but lacks meaningful connections. (AO2)
Level 3	**9–12**	• 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 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) • Argument synthesises some geographical ideas from across the course of study, making some meaningful connections. (AO2)

Level 4	**13–16**	• 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 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) • Argument comprehensively and meaningfully synthesises geographical ideas from across the course of study throughout the response. (AO2)

Question number	Answer	Mark
5(a)	**AO1 (1 mark)** Award **1** mark for the correct identification of any of the following factors: • Wind direction / speed / type / angle of wave attack • Wave energy • tides and currents / fetch • process of longshore drift • sediment size / shape • geology (for providing sediment) • Lack of river sediment / blockage • Offshore topography • Coastal management / protection / groynes Accept any other reasonable response.	(1)

Question number	Answer	Mark
5(b)(i)	**AO3 (1 mark)** Allow **1** mark for each correct final answer, rounded to nearest whole number. • Location A = 16 • Location B = 8 Do not accept answers with decimal points added.	(2)

Question number	Answer	Mark
5 (b)(ii)	**AO1 (2 marks)/AO2 (1 mark)** Award **1** mark for identifying a difference in figure 5 and a further **2** marks for explaining why location might affect the data that was collected. • Location A is more exposed / facing SW / facing prevailing wind ❶ / so the longer fetch creates destructive waves ❶ and wind energy is sustained / higher ❶ • Location B is less exposed / faces SE / not prevailing wind ❶ so the headland protects from wave / shorter fetch ❶ and wind energy is lower ❶. Accept any other appropriate response.	(3)

Question number	Answer	Mark
5(c)	**AO1 (4 marks)** For each process, award **1** mark for identifying the process and a further mark for an explaining how it affects coastal landscapes, for example: • Longshore drift ❶ transports material eroded from the headland / redistributes material along a beach ❶ • Constructive waves drop beach material because they have less energy ❶ and have stronger swash than backwash / creating beaches / spits / offshore bars / barrier beaches / tombolos / cuspate forelands ❶ • Flocculation / accretion ❶ where fine / clay particles aggregate because of reaction with salt water ❶ • Gravity settling ❶ means larger material is deposited earlier (in contrast to smaller material being transported further ❶ • Obstacles on beach / marram grass ❶ create low-energy / lee zone where material / sand is deposited ❶ • Onshore drift / marine transgression ❶ as beach material is rolled inland / sea-level rises ❶ • River flow is slowed by already established spits / bars / barrier beaches ❶ creating low energy salt marsh environments / plant succession ❶ • Long blades of cordgrass in a salt marsh can trap sediment building up a muddy substrate ❶ which help stabilise the roots of other plant species and further sediment deposition ❶ Accept any other reasonable responses. Do not accept explanations of longshore drift that purely focus on transportation. Do not accept gravity depositional (e.g. mass movement) – coastal deposition requires the action of the sea.	(4)

Question number	Answer
5(d)	**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. Relevant points may include: • Rock hardness - Softer and uncemented sediment and rock are vulnerable to cliff retreat. Igneous rocks have a stronger crystalline structure that Joints and fractures in the rock result in more complex coastal landforms – e.g. faults can be exploited to form caves, which cut through to form

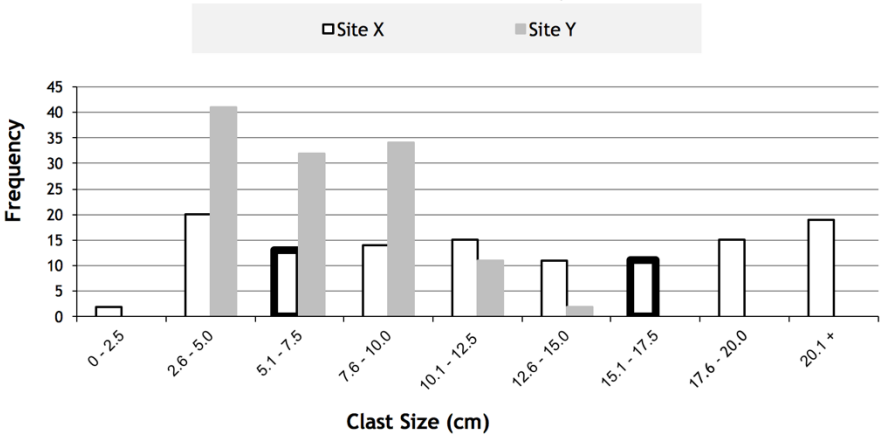
	arches, the tops of which collapse to form stacks, which over time are undermined and collapse to form stumps. • Geological orientation - A discordant coasts have different rates of erosion, resulting in headlands and bays. Headlands concentrate wave energy (refraction) resulting in more complex erosion features. • Wave type / wave energy – water is driven into cracks in rocks, compressing air that is already there, creating an explosive blast. Bombardment and blasting is made worse by sediment thrown up in the waves. The average pressure of storm waves in the UK can be 3x higher than winter waves. • Rock breakdown and erosional processes: operate on coastlines (e.g. hydraulic action / attrition / abrasion), often together with other subaerial. Some mechanical processes (solution and salt) expose the coastline to wave and sub-aerial processes. • Rock layers – differences within the cliff face affects level of resistance, different rates of erosion, and over time cause landslides. • When cliffs are worn back, a shore (wave-cut) platform is left, which can be covered by the sea at low tide, resulting in further abrasion, limestone solution and marine organisms creating a rocky foreshore (e.g. Glamorgan Heritage Coast). As the platform becomes longer, wave attack on the cliff base will decrease. Accept any other reasonable 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	**3–4**	• 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	**5–6**	• 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
5(e)	**AO1 (3 marks)/AO2 (9 marks)** **Marking instructions** Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Responses that demonstrate **only** AO1 without any AO2 should be awarded marks as follows: • Level 1 AO1 performance: 1 mark • Level 2 AO1 performance: 2 marks • Level 3 AO1 performance: 3 marks **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • Appropriate sustainable management means long-term solutions or, ensuring the resources of the landscape can be enjoyed by future generations (social), or can cope with future (unexpected?) challenges, e.g. storms / sea-level rise (environmental), or represent good value for money (economic). • The risks affecting coastlines might include coastal flooding, storm surges, coastal recession, dredging / removal of beach material, particularly when the coast is heavily developed • Sustainable management could represent a middle course between full conservation and 'do nothing'. Hard and soft engineering are other ways to manage risks, and might be part of policy decisions (which range from 'No Active Intervention', 'Strategic Realignment' to 'Hold The Line' and 'Advance The Line'). • Sustainable management can cause conflict between different local, national and global players (e.g. Jurassic Coast, conservationists, NGOs, British Geological Society). **AO2** • Businesses, farmers might be in a position to take action (e.g. strategic realignment), but this involves temporary economic loss and sometimes accepting of 'no intervention' can be more appropriate. Equally taking action to build defences can harm business in the short-term, but long-term protection can yield better profile (e.g. Lyme Regis growth in tourism post sea-defence work) • Making decisions about the appropriateness of management might consider the effects of coastal retreat - economic losses (housing, businesses, agricultural land, infrastructure) and social losses (relocation, loss of livelihood, amenity value) • Sustainable management strategies might include the use of hard and soft engineering, however their appropriate use requires specialist stakeholders who understand principles of ICZM and littoral drift and

Question number	Answer
	sediment cells. However intermediate technology might be more appropriate for some communities (e.g. mangrove plantation, mapping land-ownerships) • Sustainable management strategies can be appropriate ways to reduce exploitation of the environment (less construction at beach resorts etc), however they can be inappropriate in remote rural coastal locations, that might depend on tourism for survival (e.g. the summer surf / beach season); on the other hand reducing visual impact of engineering might increase the number of visitors to a sustainably managed coastline. • Along some coastlines, action is taken to maintain profit at the expense of human life; some players are seen as winners, whilst others are losers, and appropriate action might require the intervention of global organisations (e.g. WWF's Coastal East Africa Initiative) • Appropriate ways to manage risk to potential infrastructure (e.g. trunk roads which provide access) require capital investment by local authorities. However appropriate coastal management decisions must involve a shoreline management plan so that the needs of all players, as well as littoral cell processes are considered. • Legislative frameworks (e.g. Marine National Reserves in Kenya) might be an appropriate way to help some stakeholders see the environment as sacred / easily disrupted / essential for their future and action is needed to preserve it. On the other hand, frameworks might prevent other groups who depend on coastal environment landscapes and the challenge to 'adapt or die' is made more difficult (the management scheme becomes ineffective).

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 to produce a full and coherent interpretation knowledge and understanding of geographical information/ideas that is relevant and supported by evidence. (AO2) • Applies knowledge and understanding of geographical information/ideas to make supported judgements about the significance of factors throughout the response, leading to a balanced and coherent argument. (AO2)

Question number	Answer	Mark
6(a)(i)	**AO3 (1 mark)** Award **1** mark for completing **both** columns to show a frequency of 13 and 11 respectively.  • Accept responses that have not drawn the associated bar but correctly plotted the right line. • Accept responses that plot the bar graph in anywhere within 15.1-17.5 space. • Do not accept responses that plot at single data point.	(1)

Question number	Answer	Mark
6(a)(ii)	**AO3 (2 mark)** Award **1 mark** for each valid reason. • There are two known groups / locations – Gore Point and Hurlstone Point ❶ • It is possible to select the right number of clasts / sediment from each location ❶ • It is then possible to do a comparison ❶ • Can reduce bias • There are two subsets (Gore / Hurlstone) that make up the entire beach ❶ Accept reference to proportionately sized datasets. Do not accept 'no bias'	(2)

Question number	Answer	Mark
6(a)(iii)	**AO3 (2 marks)** Award **1 mark** for a valid reason and **1 additional** mark for justification based on the data. • The sediment has been transported by longshore drift ❶ so erosion processes have made pebbles smaller as they are transported ❶ . • Sediment material is sorted by longshore drift ❶ so that smaller material is transported further to Hurlstone Point / larger material is too large to be transported away from Gore Point ❶ • Coastal management strategies ❶ have added material of a different size to the beach ❶ • Exposure to prevailing wind ❶ means material from other locations (e.g. offshore) has been removed / deposited on the beach ❶ Accept any other reasonable response.	(2)

Question number	Answer	Mark
6(a)(iv)	**AO3 (4 marks)** For each additional technique, award **1** mark for identifying a technique that helps investigate deposition in coastal areas, and a further **1** mark for justification of why that technique would help investigate the differences between them: • Sediment / Cailleux roundness / sediment sieving ❶ – to determine how much sorting had occurred / direction of longshore drift ❶ • Create beach profiles ❶ to confirm the direction of longshore drift ❶ • Lithology study ❶ to determine the origins of glacial material alongside GIS / Geological mapping / iGeology App ❶ • Pebble shape classification / Zingg's Shape Classes ❶ to determine how erosion had changed the shape of the pebbles ❶ • Quadrat sampling ❶ to establish stability of the sediment / length of time since deposition ❶ • Pebble flatness ❶ to get objective values about pebble roundness ❶ • Field sketches / annotated photos / aerial photos / old OS maps ❶ to show evidence of longshore drift / pebble size and shape / change to profiles over time / at different locations ❶ • Wave frequency / measurements ❶ to determine constructive / destructive waves ❶	(4)

Question number	Answer	Mark
	• Floats / painted rocks ❶ to establish direction / speed of longshore drift / wave type ❶ • Chi^2, T-test ❶ to statistically test if there is a difference between the layers ❶ Accept any other appropriate response. Do not accept references to sediment size.	

Question number	Answer
6(b)	**AO3 (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. No marks for stating research question, but this should be used as the context for the answer. **Indicative content guidance** Content depends on students' choice of enquiry question and the research sources used. Assessment should include the following: • sources of information and ideas should be clearly outlined (e.g. university websites about the location, Geography Review articles, GIS data sources, newspaper articles, satellite imagery) with some supportive detail about relevance, data about the enquiry location, theoretical frameworks used to consider and plan possible fieldwork techniques. Some candidates might have been provided with baseline data, e.g. from field-studies centre or environmental monitoring networks. • links between sources and geographical investigation should be clear • the value of the sources should be clearly explained with appropriate links to how they help contextualise the geographical ideas being tested • qualifications should be evident about the information's relevance and whether it helped understand or explore the enquiry question, i.e. if it helped plan the fieldwork, write hypotheses or explain the findings of the fieldwork. All judgements are likely to be partial and tentative given the limited range of secondary sources used. Without clear understanding of the fieldwork question, an answer is unlikely to reach the top of level 2.

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	**1–3**	• Shows evidence that fieldwork investigation skills used may not have been fully appropriate or effective for the investigation of the geographical questions/issue. (AO3) • Considers the fieldwork investigation process/data/evidence, with limited relevant connections and/or judgements. (AO3) • Argument about the investigation is simplistic and/or generic. (AO3)
Level 2	**4–6**	• Shows evidence that fieldwork investigation skills used were largely appropriate and effective for the investigation of the geographical questions/issue. (AO3) • Critically considers the fieldwork investigation process/data/evidence in order to make some relevant connections and valid judgements. (AO3) • Argument about the investigation may have unbalanced consideration of factors, but is mostly coherent. (AO3)
Level 3	**7–9**	• Shows evidence that fieldwork investigation skills used were appropriate and effective for the investigation of the geographical questions/issue. (AO3) • Critically considers the fieldwork investigation process/data/evidence in order to make relevant connections and judgements that are supported by evidence. (AO3) • Argument about the investigation includes balanced consideration of factors and is fully developed and coherent. (AO3)

Question number	Answer
7	**AO1 (4 marks)/AO2 (12 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 marks **Indicative content guidance** The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: **AO1** • The region is a low lying fragile coastal zone, on a destructive plate boundary vulnerable to coastal flooding and subsidence due to subduction. • Hard engineering / hazard-resistant defences schemes help protect and sustain the economy from these threats • Fragile environments include the serious economic and social consequences of flooding for communities that live on the coast. **AO2** • Whilst this 'hard' engineering solution helps protect Venice against coastal flooding, it doesn't stop the movement of plates and subsidence caused by a subduction zone, and further sea-level rise could overwhelm these defences • The design of the flood barrier prevents coastal flooding from affecting the centre of Venice, but the barrier also threatens the natural ebb and flow of the lagoon, allowing pollution to build up, threatening wading bird habitats. • Engineering has helped design a solution that protects fragile agriculture land in Venice (e.g. allowing vineyards to flourish) but also helps create wealth for the city as a whole through tourism (figure 7a) • The flood barrier is designed to be lifted without expensive machinery or energy, however the barriers block the entrance at all three inlets, disrupting access to the harbour. • Engineering solutions are required for Venice's cultural and ecological environment to withstand rising sea level, and this is vital for generating the wealth Venice needs to maintain the defences, or might encourage residents to continue a 'life as normal' approach where building weight continues to increase. • Some candidate might note that the causes of climate change could require more global and co-ordinated responses • Overall, engineering provides a solution to some environmental challenges in Venice – more effectively for coastal flooding than the

Question number	Answer
	problems of tectonics per se, which is a sustained and irreversible threat. These solutions do facilitate the growth of the city centre industry although inadvertently creates ecological and economic problems for local communities, some of which are irreversible.

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 and rarely logical connections/relationships, 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) • Limited synthesis of geographical ideas from across the course of study. (AO2)
Level 2	**5–8**	• 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 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) • Argument partially synthesises some geographical ideas from across the course of study, but lacks meaningful connections. (AO2)
Level 3	**9–12**	• 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 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) • Argument synthesises some geographical ideas from across the course of study, making some meaningful connections. (AO2)
Level 4	**13–16**	• 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 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) • Argument comprehensively and meaningfully synthesises geographical ideas from across the course of study throughout the response. (AO2)