GCE AS MARKING SCHEME

SUMMER 2022

AS
GEOGRAPHY - COMPONENT 1
B110U10-1

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE AS GEOGRAPHY

COMPONENT 1: CHANGING LANDSCAPES

SUMMER 2022 MARK SCHEME

Guidance for Examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, as opposed to adopting an approach of penalising him / her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.
The mark scheme for this component includes both point-based mark schemes and banded mark schemes.

Point-based mark schemes

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision should be made. Each creditworthy response should be ticked in red ink. Annotations must reflect the mark awarded for the question. The targeted assessment objective (AO) is also indicated.

Banded mark schemes

For questions with mark bands the mark scheme is in two parts.
The first part is advice on the indicative content that suggests the range of concepts, processes, scales and environments that may be included in the learner's answers. These can be used to assess the quality of the learner's response. This is followed by an assessment grid advising on bands and the associated marks that should be given in responses that demonstrate the qualities needed in the three AOs, AO1, AO2 and AO3, relevant to this component. The targeted AO(s) are also indicated, for example AO2.1c.
Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks. Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. Once the annotation is complete, the mark scheme can be applied. This is done as a two stage process.

Assessment Objective	Strands	Elements
AO1 Demonstrate knowledge and understanding of places, environments, concepts, processes, interactions and change, at a variety of scales.	N/A	This AO is a single element.
AO2 Apply knowledge and understanding in different contexts to interpret, analyse and evaluate geographical information and issues.	N/A	1a - Apply knowledge and understanding in different contexts to analyse geographical information and issues.
		1b - Apply knowledge and understanding in different contexts to interpret geographical information and issues.
		1c - Apply knowledge and understanding in different contexts to evaluate geographical information and issues
AO3 Use a variety of relevant quantitative, qualitative and fieldwork skills to: • investigate geographical questions and issues • interpret, analyse and evaluate data and evidence • construct arguments and draw conclusions.	1 - investigate geographical questions and issues	N/A
	2 - interpret, analyse and evaluate data and evidence	
	3 - construct arguments and draw conclusions	

Banded mark schemes Stage 1 – Deciding on the band

Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Banded mark schemes Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), the qualities of each mark band will be discussed in detail. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

The mark scheme reflects the layout of the examination paper. Mark questions 1 and 2 or 3 and 4 in Section A, all questions in Section B and all questions in Section C. If the candidate has responded to all questions in Section A, mark all these responses. Award the higher marks attained; further, possible rubric infringements will be discussed at the marking conference.

Be prepared to reward answers that give **valid and creditworthy** responses, especially if these do not fully reflect the 'indicative content' of the mark scheme.

Section A: Coastal or Glacial Landscapes

Either: Coastal Landscapes

1. (a) Use **Figure 1** to describe the location of the Coral Triangle. Skills: 1.1, 1.3, 1.4 and 1.5	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					5		**5**

Indicative content

Answers could include the following but credit other valid responses:

- Located in South-East Asia
- East / south-east of Vietnam
- Located in a band straddling either side of the Equator – up to 2000 km north and 1500 km south
- Triangle includes Philippines, Indonesia and Papua New Guinea
- Concentrated around the Philippines and Celebes Sea in the apex of the triangle and Indonesia and Banda Sea at the base
- Lateral extension of triangle to Bismarck Sea and Solomon Sea east of Papua New Guinea
- Includes Celebes Sea and Banda Sea to the west
- Includes Bismarck Sea and Solomon Sea to the east
- From longitude 115˚E to 162˚E)
- From latitude 21˚N to 15˚S.

Award one mark for each valid response made with 1 or max 2 marks for development of any given suggestion.

(b) Outline **one** factor that contributes to the development of coral reefs. Content: 1.1.6	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	3						**3**

Indicative content

Award one mark for identifying the factor and up to 2 marks for development.

Responses may include:

- **Shallow water:** often no deeper than 45 metres / underwater volcanoes provide surfaces for corals to attach to / corals need sunlight / algae needs sunlight / photosynthesis / algae live inside most coral polyps /algae are vital because they produce chemicals that help polyps make calcium carbonate
- **Islands:** fringing reef / barrier reef / attached to edge of island / shallow water
- **Warm ocean temperatures:** algae that live in coral thrive only in warm water with tropical temperatures of between 23°C and 29°C /
- **Clear water:** well-aerated water resulting from relatively strong wave activity provides ideal conditions for coral growth as water filled with silt or other sediment would suffocate the polyps
- **Sea salinity:** Corals need saltwater to survive and require a balance in the ratio of salt to water (sea salinity levels of between 30 ppt and 40 ppt)**.** Corals are absent from where rivers drain fresh water into the sea.

1. (c) Assess impacts of conservation on coastal landscapes and landforms. Content: 1.1.9	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	6			4			**10**

Indicative content

AO1
Candidates should be able to show knowledge and understanding of the nature and purpose of conservation of coastal landscapes and landforms.

Examples could include:
- Fencing off areas of eroded pathways / sand dunes / vulnerable landscapes allows the area to recover
- Replanting vegetation stabilises sand dunes / footpaths / landforms
- Education of visitors / residents / stakeholders encourages correct behaviour and management of the landscape or landform
- AONB / National Park / SSSI / NNR status given to a coastal area, this means monitoring and preservation of landscapes, new development highly restricted
- Management of coastal protection works e.g. not allowing groynes updrift of a spit. This prevents erosion of landscapes along the coast
- Candidates might discuss negative impacts also e.g. economic costs, social impact.

Conservation practises will be clearly identified and clear links made to the impact on the coastal landform or landscape itself.

AO2
Candidates demonstrate application of knowledge and understanding through an examination of the impact of conservation on coastal landscapes and landforms. Relevant responses may include:
- The degree of success of conservation in meeting its aims
- The scale of impact on the landscape or landform
- The varying degree of impact over time
- The sustainability of the conservation practises over time / economically
- The relative importance of positive and negative impacts.

Credit any other valid points.

Award the marks as follows:		
	AO1 (6 marks)	**AO2.1c (4 marks)**
Band	*Demonstrates knowledge and understanding of the impact of conservation on coastal landforms and landscapes.*	*Applies knowledge and understanding to assess the impact of conservation strategies on coastal landforms and landscapes.*
3	**5-6 marks** Demonstrates detailed and accurate knowledge and understanding through the use of appropriate, accurate and well-developed examples. Demonstrates detailed and accurate knowledge and understanding of the purpose and nature of conservation. Demonstrates detailed and accurate knowledge and understanding of the impact of conservation on landforms and landscape.	**4 marks** Applies knowledge and understanding to produce a thorough and coherent discussion that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent assessment of the impact of conservation on coastal landforms and landscapes.
2	**3-4 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and well-developed examples. Demonstrates accurate knowledge and understanding of the purpose and nature of conservation. Demonstrates accurate knowledge and understanding of the impact of conservation on landforms and landscapes.	**2-3 marks** Applies knowledge and understanding to produce a coherent but partial discussion that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial assessment of the impact of conservation on coastal landforms and landscapes.
1	**1-2 marks** Demonstrates limited knowledge and understanding through a limited number of undeveloped examples. Demonstrates limited knowledge and understanding of the purpose and nature of conservation. Demonstrates limited knowledge and understanding of the impact of conservation on landforms and landscapes.	**1 mark** Applies knowledge and understanding to produce a discussion with limited coherence and support from some evidence. Applies knowledge and understanding to produce a limited assessment of the impact of conservation on coastal landforms and landscapes.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

2. (a) Use **Figure 2** to analyse the relationship between mean sediment size and beach slope angle. Skills: 2.11	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					5		**5**

Indicative content

- There is a direct relationship between mean sediment size and beach slope angle
- As mean sediment size increases so does beach slope angle overall
- Two anomalies exist 4 degrees and 19 degrees
- Where mean sediment size > 4mm the greater the variation in beach slope angle
- Smaller mean sediment sizes ranging from 0.35mm-5mm correspond with lower beach slope angles ranging between 4 -11 degrees
- Larger mean sediment sizes ranging from 6mm-15mm correspond with steeper beach slope angles ranging between 11-19 degrees.

Marking guidance

Responses must address the question and refer to the relationship between sediment size and beach slope angle. Some candidates will drift into explanation and this should not be credited.

Credit any other valid points.

Award the marks as follows:

Band	Marks	
3	**4-5**	Clear relationship between mean sediment size and beach slope angle. Consistent and accurate use of the resource as a source of data to support the analysis. Not all elements of the graph need to be described to reach this band.
2	**2-3**	Some identification of the relationship between mean sediment size and beach slope angle. Partial use of the resource as source of data to support the description.
1	**1**	Simple statements of varying validity. Limited use of the resource as a source of data. No links made.
	0	No valid comment.

2. (b) 'The main influence on the distribution of erosional coastal landscape systems is the length of fetch.' Discuss. Content: 1.1.2 and 1.1.3	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	5			7			**12**

Indicative content

Candidates should demonstrate knowledge and understanding of a range of factors affecting processes at the coast, and link this to the distribution of erosional landscapes. Responses may include the following.

AO1

Erosional coastal landscape systems form as a result of:

- High energy waves which have most power to erode. These are driven by high winds primarily but also build over a long fetch
- Large fetch. Waves build height over a distance, higher waves have more energy to erode.
- High exposure. Some areas of coastline are exposed to prevailing winds and a large fetch. Others are sheltered by islands or by their location in relation to prevailing wind
- Limited deposition / drift aligned coasts that are influenced by longshore drift. This transfer of sediment along the coast limits the development of beaches and leads to greater cliff exposure, hence faster rates of erosion
- Discordant geology helps to create typical headland and bay features that also erode over time to form wave-cut platforms and arches and stacks
- Rock type. Some rock types / cliff material are more resistant to erosion than others.
- Waves approaching headlands slow down in shallower water and build height creating destructive waves. The waves become refracted around the headland and so wave energy becomes concentrated on the sides of the headland. This speeds up the process of the creation of caves, arches and stacks.

AO2

Marking guidance

Those that score well will address the question and provide some judgement on the importance of the length of fetch in determining the distribution of erosional coastal landscape systems.
Those at the lower end may simply comment on there being a range of factors affecting erosion at the coast.

Responses may include:

- Discussion of the significance of different factors in determining rates of erosion
- Comments on how the different factors affect the distribution of the erosional landscape systems
- A judgement on whether length of fetch is the most important factor affecting distribution of erosional landscape systems
- An understanding of the interdependence of factors.

In order to reach band 3 there will be a substantiated conclusion that links clearly to the question.

Credit any other valid points.

Award the marks as follows:		
	AO1 (5 marks)	**AO2.1c (7 marks)**
Band	*Demonstrates knowledge and understanding of influences on the distribution of erosional coastal landscape systems.*	*Applies knowledge and understanding to evaluate the extent to which a long fetch is the main influence on the distribution of erosional coastal landscape systems.*
3	**4-5 marks** Demonstrates detailed and accurate knowledge and understanding through the use of appropriate, accurate and well-developed examples. Demonstrates detailed and accurate knowledge and understanding of range of influences on the distribution of erosional coastal landscape systems. Well annotated sketches / diagrams / maps may also be used and should be credited.	**6-7 marks** Applies knowledge and understanding to produce a thorough and coherent discussion that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent discussion on the extent to which length of fetch is the main influence on the distribution of erosional coastal landscape systems. A substantiated conclusion will be evident.
2	**3-5 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and developed examples. Demonstrates accurate knowledge and understanding of some of the influences on the distribution of erosional coastal landscape systems. Sketches / diagrams / maps may also be used and should be credited.	**3-5 marks** Applies knowledge and understanding to produce a coherent but partial discussion that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial discussion on the extent to which length of fetch is the main influence on the distribution of erosional coastal landscape systems.
1	**1-2 marks** Demonstrates limited knowledge and understanding through a limited number of underdeveloped examples. Demonstrates limited understanding of some influences on the distribution of erosional coastal landscape systems. Sketches /diagrams / maps may be used and can be credited.	**1-2 marks** Applies knowledge and understanding to produce a discussion with limited coherence and support from some evidence. Applies knowledge and understanding to produce a limited discussion on the extent to which length of fetch is the main influence on the distribution of erosional coastal landscape systems.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

Or: Glaciated Landscapes

3. (a) Use **Figure 3** to describe the location of the Vatnajökull ice sheet. Skills: 1.1, 1.3, 1.4 and 1.5	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					5		**5**

Indicative content

- Longitude 15W to 18W
- Latitude 64N to 65N
- South of the Arctic Circle
- South-east of Iceland
- Located on highland above 750 m
- Extends 125km West to East
- Extends 100km North to South
- 150km East of Reykjavik
- Reference location relative to named places.

Credit any other valid points. Award one mark for each valid response made with 1 or max 2 marks for development of any given suggestion.

(b) Outline **one** difference between warm-based and cold-based glaciers. Content: 1.2.3	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	3						**3**

Indicative content

Award one mark for identifying the difference and up to 2 marks for development.

- **Location:** Warm-based glaciers are found in lower latitudes than cold-based / temperatures are above freezing seasonally
- **Velocity:** the ice moves relatively rapidly (up to 3m per day) in warm-based glaciers / cold-based glaciers move more slowly (2cm per day) / reference to mechanisms of movement
- **Movement:** warm-based - movement largely through basal sliding / Cold-based glaciers move due to internal deformation / explanation of this
- **Meltwater**: lubricates movement of ice in warm-based glaciers /far less a presence in cold-based glaciers / explanation of this
- **Friction:** warm-based glacier increases the temperatures at the base due to friction and pressure / Cold-based glaciers are frozen to the bed so there is no friction
- **Variation:** less seasonal variation in temperature in cold-based glaciers / those found in the lower latitudes (warm-based) will experience temperatures above freezing seasonally.
- **Erosional processes:** Abrasion and plucking are more active in warm-based glaciers / due to basal sliding, melting and re-freezing of the base.
- **Glacier bed:** Bed deformation more prevalent in warm-based glaciers / Ground is frozen under a cold-based glacier.

Credit any other valid points.

3. (c) Assess impacts of a decrease in snowfall on the glacier system. Content: 1.2.1, 1.2.2	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	6			4			**10**

Indicative content

AO1
Candidates should show knowledge and understanding of the glacial system of inputs, stores, transfers and outputs. Candidates should make clear links between snowfall (an input) and the rest of the system.

- Decrease in inputs to the system, means the mass balance is negative
- Equilibrium line / snow line / accumulation zone will move upslope
- Position of the snout will retreat as ablation is greater than accumulation
- Thickness of glacier will be reduced
- Velocity of glacier may decrease
- Decrease in albedo in the area, triggering more warming of the atmosphere and further loss of snow and ice (positive feedback).

AO2
Candidates demonstrate application of knowledge and understanding through an assessment of the impact of a decrease in snowfall on the glacier system. Relevant responses may include:

- The scale of the impact / significance of snowfall as an input (relative to avalanches / windblown snow)
- Positive feedback within the system increases the impact over longer timescales
- The varying degree of impact by location – polar glaciers are less responsive than Alpine glaciers.
- Timescales – seasonal / climate change
- Impact of decrease in snowfall on energy levels in glacier system – shrinkage in glacier is associated with reduced erosion rates within system but glacier recession often leads to slope destabilisation and increased mass movement at its margins.

Some responses may include annotated diagrams which could carry credit.

Credit any other valid points.

Award the marks as follows:		
	AO1 (6 marks)	**AO2.1c (4 marks)**
Band	*Demonstrates knowledge and understanding of the impact of a decrease in snowfall on the glacier system.*	*Applies knowledge and understanding to assess the impact of a decrease in snowfall on the glacier system.*
3	**5-6 marks** Demonstrates detailed and accurate knowledge and understanding of the impact of a decrease in snowfall on the glacier system. Demonstrates detailed and accurate knowledge and understanding of the operation of the glacier as a system. Well annotated sketches / diagrams / maps may also be used and should be credited.	**4 marks** Applies knowledge and understanding to produce a thorough and coherent discussion that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent assessment of the impact of a decrease in snowfall on the glacier system.
2	**3-4 marks** Demonstrates accurate knowledge and understanding of the impact of a decrease in snowfall on the glacier system. Demonstrates accurate knowledge and understanding of the operation of the glacier as a system. Sketches / diagrams / maps may also be used and should be credited.	**2-3 marks** Applies knowledge and understanding to produce a coherent but partial discussion that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial assessment of the impact of a decrease in snowfall on the glacier system.
1	**1-2 marks** Demonstrates limited knowledge and understanding of the impact of a decrease in snowfall on the glacier system. Demonstrates limited knowledge and understanding of the operation of the glacier as a system. Basic sketches / diagrams / maps may be used and can be credited.	**1 mark** Applies knowledge and understanding to produce a discussion with limited coherence and support from some evidence. Applies knowledge and understanding to produce an assessment with limited coherence of the impact of a decrease in snowfall on the glacier system.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

4. (a) Use **Figure 4** to analyse the relationship between mean scree particle size and scree slope angle. Skills 2.11	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					5		**5**

Indicative content

- There is an inverse/ negative relationship between mean scree particle size and scree slope angle
- As mean scree particle size increases the mean scree slope angle decreases. Larger scree particle sizes are found on lower slope angles
- Two anomalies include a smaller scree particle size of 22 cm at a lower scree slope angle of 20 degrees and a slightly 'larger' scree particle size of 27 cm at a higher scree slope angle of 35 degrees
- Where mean scree particle size is < 30 cm, the greater the variation in scree slope angle
- Smaller mean scree particle sizes ranging from 0 to 30 cm correspond with higher scree slope angles above 20 degrees
- Larger mean scree particle sizes > 50 cm correspond with lower scree slope angles ranging between 15 to 20 degrees.

Marking guidance

Responses must address the question and refer to the relationship between mean scree particle size and scree slope angle. Some candidates will drift into explanation and this should not be credited. Credit any other valid points.

Award the marks as follows:

Band	Marks	
3	**4-5**	Clear relationship between mean scree particle size and scree slope angle. Consistent and accurate use of the resource as a source of data to support the analysis. Not all elements of the graph need to be described to reach this band.
2	**2-3**	Some identification of the relationship between mean scree particle size and scree slope angle. Partial use of the resource as source of data to support the description.
1	**1**	Simple statements of varying validity. Limited use of the resource as a source of data. No links made.
	0	No valid comment.

4. (b) 'The main influence on rates of glacial erosion is ice thickness.' Discuss. Content: 1.2.3, 1.2.5	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	5			7			**12**

Indicative content

Candidates should demonstrate knowledge and understanding of a range of factors affecting rates of glacial erosion. Responses may include the following.

AO1
Factors affecting the rate of glacial erosion are:

- **Thermal regime** - warm-based glaciers move downslope much more rapidly, causing abrasion and plucking. Cold-based glaciers move through internal deformation and therefore these erosional processes are largely absent.
- **Ice velocity** - faster moving glaciers will cause more abrasion as more material is moved within the ice more quickly. Higher velocity likely to be due to meltwater at base, which will refreeze periodically and cause plucking.
- **Ice thickness** - thicker ice exerts more pressure on the valley floor and sides causing more rapid erosion by abrasion and plucking. Thicker ice also causes pressure melting at the base in warm based glaciers, allowing velocity to increase.
- **Bedrock permeability** - where meltwater is able to percolate into the rocks it is not available to lubricate the glacier movement. Impermeable rocks means that subglacial streams and meltwater increase glacier velocity and rates of erosion, including fluvio-glacial erosion.
- **Jointing of bedrock** - well jointed rocks are more vulnerable to the process of plucking. The jagged rocks within the glacier are then used for abrasion.
- **Nature of basal load** - very resistant and sharp basal load will erode more effectively.

AO2
Candidates will apply knowledge in order to evaluate the relative importance of ice thickness in controlling rates of glacial erosion. Responses may include:

- Discussion of the significance of different factors in determining rates of erosion.
- The inter-relationships between different factors that control rates of erosion e.g. ice thickness impacts on presence of meltwater and glacier velocity.
- The influence of ice thickness in different locations. In cold-based regimes glacier movement and erosion is limited irrespective of ice thickness, in warm-based regimes it has more influence.
- A judgement on whether ice thickness has most influence on rates of erosion.

Marking guidance

Those that score well will address the question and provide some judgement on the importance of ice thickness in controlling rates of glacial erosion.
Those at the lower end may simply comment on there being a range of factors affecting rates of glacial erosion.

In Band 3 (AO2) there will be a substantiated conclusion that links clearly to the question.

Credit any other valid points.

Award the marks as follows:		
	AO1 (5 marks)	**AO2.1c (7 marks)**
Band	*Demonstrates knowledge and understanding of factors affecting rates of glacial erosion.*	*Applies knowledge and understanding to evaluate the influence of ice thickness on rates of glacial erosion.*
3	**5 marks** Demonstrates detailed and accurate knowledge and understanding of a range of factors that affect rates of glacial erosion. Well annotated sketches / diagrams / maps may also be used and should be credited.	**6-7 marks** Applies knowledge and understanding to produce a thorough and coherent discussion that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent discussion on whether ice thickness is the main influence on rates of glacial erosion. A substantiated conclusion will be evident.
2	**3-4 marks** Demonstrates accurate knowledge and understanding of some factors that affect rates of glacial erosion. Sketches / diagrams / maps may also be used and should be credited.	**3-5 marks** Applies knowledge and understanding to produce a coherent but partial analysis that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial discussion on whether ice thickness is the main influence on rates of glacial erosion.
1	**1-2 marks** Demonstrates limited understanding of factors affecting rates of glacial erosion. Sketches /diagrams / maps may be used and can be credited.	**1-2 marks** Applies knowledge and understanding to produce an analysis with limited coherence and support from some evidence. Applies knowledge and understanding to produce a limited analysis and discussion on whether ice thickness is the main influence on rates of glacial erosion.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

Section B: Tectonic Hazards

5. (a) Use **Figure 5** to compare the two hazard profiles. Skills: 8.2	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					5		**5**

Indicative content

- **Areal extent:** The tsunami covered a wide area whereas the eruption was limited in extent (1)
- **Magnitude:** the tsunami was of an enormous magnitude whereas the eruption was small (1)
- **Duration:** the eruption had a long duration whereas the tsunami was of a short duration (1)
- **Speed of onset**: the tsunami had a short onset whereas the eruption had a long onset time (1)
- **Predictability:** the eruption was considered more predictable than the tsunami (1)
- **Frequency:** the tsunami in Asia is considered a rare event whereas the eruption of Kilauea occurs frequently (1)
- **Overall:** The two events show mainly opposite profiles (1).

Marking guidance

Award 1 mark for each **comparison** made. Maximum of four marks for direct lift from the resource. Reserve one mark for comments that draw a conclusion about the relative similarity or difference between the two events.

Credit any other valid points.

(b) Use **Figure 6** to describe the likely impacts of this eruption on people and the built environment. Content: 1.3.4 Skills: 8.2	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					4		**4**

Indicative content

- Roads are damaged by lava flows / two roads are affected which disrupts transport (1)
- Lava will solidify and block roads / roads impassable which disrupts transport (1)
- Lava cannot be removed so roads will need to be rerouted which is very costly (1)
- Transport disruption can affect people's ability to access work (1)
- Transport disruption can negatively affect businesses that need deliveries / transport goods (1)
- Houses are at risk of burning or being engulfed leaving people homeless (1)
- People will need to rebuild houses which is very costly (1)
- This area may be abandoned which is traumatic for people / breaks up communities (1)
- Power supplies or water pipes underground may be damaged / other services e.g. street lights are evident in the photo (1)
- Lack of power and / or water supply has a negative impact on people's wellbeing / health (1).

Marking guidance

No credit should be given for comments not applicable to the photo. For full marks, there must be comment on both people and the built environment. 3 marks maximum if only one is discussed.

Credit any other valid points.

Award the marks as follows:

Band	Marks	
3	**4**	Detailed description of two or more impacts with clear links made to evidence from the photographs.
2	**2-3**	Lacks detail or could focus on one impact. Some links made to evidence from the photograph.
1	**1**	Partial statements made with limited understanding of the impacts seen in the photographs.
	0	No valid comment.

5. (c) (i) Use **Figure 7** to: Calculate the median value for the number of earthquakes per year in California from 2010 to 2015. Skills: 2.9	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					2		**2**
Correct answer for median = **217.5** (2) Credit correct process with 1 mark if workings are shown (rank order) but answer is incorrect							
(ii) Use **Figure 7** to: Calculate the mean number of earthquakes per year in California from 2010 to 2015. Skills 2.9	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					2		**2**
Correct answer **257.5** (2) Credit correct process with 1 mark if workings are shown but answer is incorrect.							
(iii) Outline **one** disadvantage of using the mean value when studying the frequency of earthquakes in California from 2010-2015. Skills 2.9	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					3		**3**

Indicative content

- The mean is influenced by skewed data or anomalies (1) / 2010 value unusually high (1) / quantification (1)
- The range in this data set is large (1) quantification (1) so the value is rather meaningless (1)
- The mean is more useful with larger data sets (1) one value has too much influence (1).
- The time scale is quite short (1) only 5 years (1)

Credit any other valid responses.

(iv) Use only **Figure 8** to analyse the relationship between earthquake magnitude and frequency. Skills 2.5	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					4		**4**

Indicative content

- The higher the magnitude the lower the frequency
- There were very few earthquakes of 8+ / one a year is most usual (1)
- There is a large decrease in frequency from magnitude 6.0-6.9 to magnitude 7.0-7.9 (1)
- Decrease in frequency from magnitude 5.0-5.9 to 6.0-6.9 is also large,
- Credit any manipulation of data e.g. 91% of earthquakes in 2016 were below magnitude 6
- Remarkably consistent pattern, number of earthquakes at magnitude 6.0-6.9 is 7-8% of the number at magnitude 5.0-5.9
- Number of earthquakes at magnitude 7.0-7.9 is around 13% of the number at 6.0-6.9 (1) with the exception of 2017 (1).

Responses must address the question and refer to the **link** between frequency and magnitude in some way.

5. (d) Explain how tectonic plates are thought to move. Content: 1.3.1	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	6						**6**

Indicative content

- The mechanism by which tectonic plates move is complex and is a subject of debate
- Until recently, the temperature gradient within the semi molten mantle was thought to create convection currents
- These diverging currents were thought to pull apart plates / lithosphere
- At diverging margins - magma erupts and forces plates apart / sea floor spreading / creation of new oceanic plate / mid-ocean ridge is elevated, gravity pulls plate outwards and downwards away from the margin (ridge push)
- Converging currents pull two or more plates towards each other / drag plates into mantle (slab pull)
- Subduction destroys oceanic crust.
- However, modern imaging techniques have been unable to identify convection currents in the mantle sufficiently large enough to drive plate movement
- The injection of magma at divergent plate boundaries occurs due to the thinning of the lithosphere and the associated decrease in pressure causes partial melting of the upper mantle
- As the lithosphere is heated it is elevated to form an ocean ridge of relatively hot, younger and less dense rock producing a slope down from the ridge which is made of cooler, older and denser rock
- Gravity acts on the older, denser lithosphere (gravitational sliding) that is now considered to be the active force driving plate movement
- Slab pull occurs at subduction zones at convergent boundaries where the colder, denser parts of the plate sink into the mantle pulling the plate along
- Therefore ridge push is now considered to be a passive process and slab pull is regarded as the main mechanism for plate movement.

Marking guidance

Credit either the original theory based on the role of convection currents or the more recent theory of gravitational sliding as the mechanism driving plate movement. Some candidates will attempt the question through an annotated sketch, which is acceptable. Near the lower end there will be limited discussion of the mechanisms involved.

	AO1 (6 marks)
Band	*Demonstrates knowledge and understanding of the mechanisms of the movement of the tectonic plates.*
3	**5-6 marks** Demonstrates detailed and accurate knowledge and understanding of the mechanisms of movement of the tectonic plates. Well annotated sketches / diagrams / maps may also be used and should be credited.
2	**3-4 marks** Demonstrates accurate knowledge and understanding of the mechanisms of movement of the tectonic plates. Sketches / diagrams / maps may also be used and should be credited.
1	**1-2 marks** Demonstrates limited understanding of the mechanisms of movement of the tectonic plates. Sketches /diagrams / maps may be used and can be credited.
	0 marks Response not creditworthy or not attempted.

5. (e) Evaluate the importance of prediction and mitigation in reducing risks associated with volcanic activity. Content: 1.3.8	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	7			7			**14**

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

AO1
AO1 content encompasses knowledge and understanding of prediction and mitigation strategies and their impact on reducing risks associated with volcanic activity. The content will depend on the examples chosen to illustrate the strategies used but there are some factors that will be common in responses.

- Description of the hazard management cycle and where prediction and mitigation fits into this
- Monitoring volcanoes enables prediction
- Prediction enables time to organise evacuation / warnings / mitigation of impacts
- Mitigation involves – barriers to lava flows / educating public on emergency procedures / training emergency services / evacuation plans / aid for people affected / shutting down of infrastructure e.g. airports.

AO2
Candidates demonstrate application of knowledge and understanding through a discussion of the importance of prediction and mitigation in reducing risks associated with volcanic activity. Relevant responses may include:

- Comparison of the importance of prediction and mitigation in relation to responses during and after an event
- Prediction is more effective the longer the timescales involved
- Examples to illustrate impacts on death rates and damage in areas with varying degrees of preparedness
- Discussion of prediction and mitigation as part of the hazard management cycle, the reliance of each part of the cycle on the others i.e. without prediction there can be no mitigation or targeted short term response.

Marking guidance

Answers that score well will give a clear and synoptic approach which may be linked to other aspects of the hazard management cycle. Candidates may use two contrasting examples to evaluate the importance of prediction and mitigation in context. Near the lower end points are isolated and not well linked.

In Band 3 (AO2) there will be a substantiated conclusion that links clearly to the question.

Credit other valid points.

Award the marks as follows:		
	AO1 (7 marks)	**AO2.1c (7 marks)**
Band	*Demonstrates knowledge and understanding of prediction and mitigation strategies in reducing risks associated with volcanic activity.*	*Applies knowledge and understanding to evaluate the degree of importance of prediction and mitigation in reducing risks associated with volcanic activity.*
3	**6-7 marks** Demonstrates detailed and accurate knowledge and understanding through the use of appropriate, accurate and well-developed examples. Demonstrates detailed and accurate knowledge and understanding of the impact of prediction and mitigation strategies in reducing risks associated with volcanic activity. Well annotated sketches / diagrams / maps may also be used and should be credited.	**6-7 marks** Applies knowledge and understanding to produce a thorough and coherent evaluation that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent evaluation of the importance of prediction and mitigation in reducing the risks associated with volcanic activity. A substantiated conclusion will be evident.
2	**3-5 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and developed examples. Demonstrates accurate knowledge and understanding of the impact of the impact of prediction and mitigation strategies in reducing risks associated with volcanic activity. Sketches / diagrams / maps may also be used and should be credited.	**3-5 marks** Applies knowledge and understanding to produce a coherent but partial evaluation that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial evaluation of the importance of prediction and mitigation in reducing the risks associated with volcanic activity.
1	**1-2 marks** Demonstrates limited knowledge and understanding through a limited number of underdeveloped examples. Demonstrates limited understanding of the impact of prediction and mitigation strategies in reducing risks associated with volcanic activity. Sketches /diagrams / maps may be used and can be credited.	**1-2 marks** Applies knowledge and understanding to produce an evaluation with limited coherence and support from some evidence. Applies knowledge and understanding to produce a limited analysis and evaluation of the importance of prediction and mitigation in reducing the risks associated with volcanic activity.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

6. (a) Assess how risks from volcanic activity vary from one place to another. Content: 1.3.4, 1.3.7	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	10			5			**15**

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks.

AO1

AO1 content encompasses knowledge and understanding. The content will depend upon the regions chosen but there will be a number of common threads for credit.

- Definition of risk – risk is defined as the probability of a hazard occurring and creating loss of lives and livelihoods. It is summarised in the risk equation which measures the level of hazard risk for an area
- Risks from volcanic activity result from a combination of: (i) the intrinsic physical properties of a volcanic hazard (predictability, frequency, magnitude, duration, speed of onset and areal extent) and (ii) the extrinsic areal or local factors that influence the level of vulnerability of the population and their capacity to cope (resilience)
- Risks from volcanic activity include the hazards of pyroclastic flows, lava flows, ash falls, lahars, jokulhlaups, volcanic landslides and toxic gases
- Vulnerability and resilience are influenced by economic, social and political factors
- The degree of risk will vary with the example chosen but may include the type of plate margin
- Nature of primary hazards
- Nature of secondary hazards
- Past volcanic activity
- Economic, social and political factors influencing vulnerability and resilience
- Location – urban or rural, level of wealth, time of day, degree of isolation.

AO2

Risks vary from place to place as a result of spatial and temporal variations in the physical properties of volcanic activity and the vulnerability and resilience of the population affected such as:

- Distance-decay effect i.e. distance from the volcanic activity
- Difference in risks due to the position of the place along the development continuum i.e. developed or developing (LIC/NIC/HIC)
- Difference in risk due to magnitude of volcanic activity
- Difference in risk due to type of eruption e.g. effusive or explosive (type of plate margin)
- Difference in risk due to nature of place affected e.g. remote rural v urban
- Difference in risk due to the economic, social and political factors that influence risk and vulnerability.

Marking guidance

Answers that score well will use accurately located examples and assess the specific nature of the risks in different regions. A judgement as to the **varying** degree of risk within a located place and between places will also be evident. Award a maximum of 10 if answer relates to other tectonic hazards.

Award the marks as follows:		
	AO1 (10 marks)	**AO2.1c (5 marks)**
Band	*Demonstrates knowledge and understanding of risks associated with **at least two** volcanic regions.*	*Applies knowledge and understanding to assess the factors causing variations in the degree of risk between volcanic regions*
3	**8-10 marks** Demonstrates detailed and accurate knowledge and understanding through the use of appropriate, accurate and well-developed examples. Demonstrates detailed and accurate knowledge of the risks associated with **two or more** volcanic regions. Well annotated sketches / diagrams / maps may also be used and should be credited.	**4-5 marks** Applies knowledge and understanding to produce a thorough and coherent assessment of the factors causing variations in the degree of risk between volcanic regions, that is supported by evidence.
2	**4-7 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and developed examples. Demonstrates accurate knowledge and understanding of the risks associated with **two or more** volcanic regions. At the lower end there may be a lack of balance between examples used. Sketches / diagrams / maps may also be used and should be credited.	**2-3 marks** Applies knowledge and understanding to produce a coherent but partial assessment of the factors causing variations in the degree of risk between volcanic regions, that is supported by some evidence.
1	**1-3 marks** Demonstrates limited knowledge and understanding through a limited number of underdeveloped examples. Demonstrates limited understanding of the risks associated with **two** volcanic regions. Lack of balance between examples used, or only one region discussed. Sketches /diagrams / maps may be used and can be credited.	**1 mark** Applies knowledge and understanding to produce an assessment of the factors causing variations in the degree of risk associated with volcanic regions, with limited coherence and support from some evidence.
	0 marks Response not creditworthy or not attempted	**0 marks** Response not creditworthy or not attempted

6. (b) Evaluate the effectiveness of short-term and long-term responses to seismic events in countries at different levels of development. Content: 1.3.8, 1.3.9	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	10			10			**20**

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks.

AO1
AO1 content encompasses knowledge and understanding. The content will depend upon the regions chosen but there will be a number of common threads for credit. The type of responses selected will vary with the examples chosen but may encompass the following:

Short-term responses:
- Survivors attempts to locate people under rubble / to administer first aid / to find shelter and water
- International appeals for donation / volunteers
- Charities send supplies, equipment and volunteers to the country affected
- Attempts to access the affected areas by clearing roads / use of helicopters
- Media spreads awareness of the event worldwide
- Survivors moved to safe locations / hospitals outside the affected region
- Fires dealt with
- Identifying missing persons / dead bodies / helplines for families with relatives / friends in the affected area
- Disaster Aid from international governments
- Recognition that LICs may generate a more generous short-term response in terms of aid and donations as perception is that they need it more than a HIC.
- Recognition that HICs may respond more quickly as they have more resources and highly trained emergency services.

Long-term responses:
- Investment in rebuilding programmes
- Investigations into effectiveness of mitigation plans / engineering of aseismic buildings to withstand seismic activity to inform future planning
- Improvement of strategies to increase preparedness of the public, emergency services and businesses based on experience
- Businesses given financial help to recover so that the long-term impact on the country's economy is minimised
- Recognition that long-term responses in LICs are absent or limited due to low GDP and significant drop off in aid as international interest wanes.
- Recognition that long-term responses will often be at an individual / village level rather than a more strategic national response in a LIC.

Credit any other valid points

AO2
Candidates demonstrate application of knowledge and understanding through an evaluation of the effectiveness of short- and long-term responses in different countries. The discussion may include:

- How quickly countries at different levels of development recover
- The extent to which different countries recover (recognition that standards of living before the event may never be recovered in some countries / regions)
- The preparedness of different countries / evaluation of the nature of responses
- Comparison of the relative effectiveness of short- and long-term responses
- The interdependence of short- and long-term responses

Marking guidance

Answers that score highly will use accurately located examples and evaluate specific responses in different countries. A judgement as to the effectiveness of the responses between places will be evident. Award a maximum of 10 if answer relates to volcanic hazards.

In Band 3 (AO2) there will be a substantiated conclusion that links clearly to the question.

Credit any other valid points.

Award the marks as follows:		
	AO1 (10 marks)	**AO2.1c (10 marks)**
Band	*Demonstrates knowledge and understanding of short- and long-term responses to seismic events in countries at different levels of development.*	*Applies knowledge and understanding to evaluate the effectiveness of short- and long-term responses to seismic events in countries at different levels of development.*
3	**8-10 marks** Demonstrates detailed and accurate knowledge and understanding through the use of appropriate, accurate and well-developed examples. Demonstrates detailed and accurate knowledge of the nature of short- and long-term responses to seismic events in countries at different levels of development. Well annotated sketches / diagrams / maps may also be used and should be credited.	**8-10 marks** Applies knowledge and understanding to produce a thorough and coherent evaluation of the effectiveness of short- and long-term responses in countries at different levels of development, that is supported by evidence. A substantiated conclusion will be evident.
2	**4-7 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and developed examples. Demonstrates accurate knowledge of the nature of short- and long-term responses to seismic events in countries at different levels of development. At the lower end there may be a lack of balance between examples used. Sketches / diagrams / maps may also be used and should be credited.	**4-7 marks** Applies knowledge and understanding to produce a coherent but partial evaluation of the effectiveness of short- and long-term responses in countries at different levels of development, that is supported by evidence.
1	**1-3 marks** Demonstrates limited knowledge and understanding through a limited number of underdeveloped examples. Demonstrates limited knowledge of the nature of short- and long-term responses to seismic events in countries at different levels of development. Lack of balance between examples used or may only discuss one country. Sketches /diagrams / maps may be used and can be credited.	**1-3 marks** Applies knowledge and understanding to produce an evaluation of the effectiveness of short- and long-term responses in countries at different levels of development, with limited coherence and support from some evidence. May only address one country / region.
	0 marks Response not creditworthy or not attempted	**0 marks** Response not creditworthy or not attempted

Section C: Challenges in the 21st Century

7. 'Human innovation and investment in places minimise negative impacts of change.' Discuss. Suggested Focus: 1.1.8, 1.2.9, 1.3.8, 1.3.9, 2.1.4, 2.1.6, 2.1.8	AO1	AO2.1a	AO2.1b	AO2.1c	AO3.1	AO3.2	**Total**
			10				**10**

Within the answer to question 7, candidates may use Figures 9a to 9c, together with appropriate knowledge and understanding of the connections between different aspects of this area across the whole specification in order to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

Indicative content

Figure 9a shows significant coastal protection works around Hornsea (1.1.8). This will provide a potential stimulus for discussion on the impact of innovation and investment in sea defences set against the risks brought by climate change and coastal erosion processes.

Figure 9b shows a photo of a dam across a glaciated valley in the Alps; plans to mitigate against loss of water supply as glaciers retreat have led to the creation of these dams (1.2.9). This will provide stimulus to discuss how negative impacts of climate change and change in mass balance of glaciers can be offset with innovation and investment.

Figure 9c shows the redevelopment of Cardiff Bay after the docks closed down (2.1.4). This will provide a stimulus for discussion of how change in human places can be managed through re-imaging and regenerating, requiring innovation and investment (2.1.6 and 2.1.8).

Some answers may argue that human innovation can trigger negative change e.g. negative environmental and social impacts. In addition it may be argued that human innovation cannot continue to halt natural processes such as erosion, and conversely that investment in mitigation strategies relating to tectonic hazards can have some measure of success (1.3.8 and 1.3.9).

Near the lower end there will be limited understanding of the way in which innovation and investment can minimise negative impacts of change in places.

Marking guidance

Accept answers that look at change in **either** coastal areas **or** glaciated areas alongside change in human places. Accept also answers that access knowledge and understanding across other areas of the specification. Do not limit credit to discussion stimulated directly by the photographs.

Credit any other valid points.

Award the marks as follows:		
Band	**Marks**	**AO2.1c (10 marks)**
3	**7-10**	Applies knowledge and understanding from across the specification to produce a thorough and coherent evaluation that is supported by evidence. Well-developed synthesis of geographical ideas, concepts and issues from the resources provided and from across the specification and in different contexts, in order to make well-judged connections. Applies knowledge and understanding from across the specification to evaluate to what extent human innovation and investment can minimise negative impacts of change in places.
2	**4-6**	Applies knowledge and understanding from across the specification to produce a coherent but partial evaluation that is supported by some evidence. Partial synthesis of geographical ideas, concepts and issues from the resources provided and from across the specification and in different contexts, in order to make partial connections. Applies knowledge and understanding from across the specification to partially evaluate to what extent human innovation and investment can minimise negative impacts of change in places.
1	**1-3**	Applies knowledge and understanding from across the specification to produce an evaluation with limited coherence and support from some evidence. Limited synthesis of geographical ideas, concepts and issues from the resources provided and from across the specification and in different contexts, making limited connections. Limited application of knowledge and understanding from across the specification to evaluate to what extent human innovation and investment can minimise negative impacts of change in places.
	0	Response not creditworthy or not attempted.