GCE AS MARKING SCHEME

SUMMER 2024

AS
GEOGRAPHY – UNIT 1
2110U10-1

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About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

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GCE AS GEOGRAPHY

UNIT 1: CHANGING LANDSCAPES

SUMMER 2024 MARK SCHEME

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. 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.

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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	

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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 and all questions in Section B. 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.

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Section A: Coastal or Glacial Landscapes

Either: Coastal Landscapes

1. (a) (i) State the six-figure grid reference of the Salt House (X).	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					1		**1**

Acceptable answers

- 472846 (accept +/- 1 either way e.g. 473845)

1. (a) (ii) Use **Figure 1a and 1b** to give the direction in which the camera was facing when the photograph was taken.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					1		**1**

Acceptable answers:

- SW
- WSW
- SSW

1. (a) (iii) Use **Figure 1a** and the **Resource Folder** to describe the characteristics of Port Eynon Beach.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid point.					3		**3**

Indicative content

- The beach runs south-west (SW) to north-east (NE) or south south-west (SSW) to east north-east (ENE) / faces south-east (SE) (1)
- There are sand dunes running SW to NE or SSW to ENE (1)
- The beach is curved/ a bayhead beach (1)
- The beach is sandy with some shingle (1)
- Wave cut platform visible at low tide (1) up to 0.5 km wide (1) it is rocky / irregular (1).
- Credit any accurate distance or area calculations.

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(iv) Suggest **one** way in which the coastal landscape in **Figures 1a and 1b** could have a positive impact on human activity**.**	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for stating a positive impact and two marks for development.		3					**3**

This question tests the candidate's ability to apply their knowledge to the area shown on the map.

Indicative content

- Tourists are attracted to the dunes or the beach (1) which brings money / jobs to the local area / Horton / Port Eynon (1) and more opportunities for leisure activities (1)
- The dunes or beach are a natural sea defence (1) there is no need to spend money on building defences (1) there is low risk of erosion or flooding in Port Eynon / Horton (1)
- Dunes are an important wildlife habitat (1) scientists / people enjoy seeing the plants and animals (1)
- There is a nature reserve on the rocks / wave cut platform (1) people enjoy watching nature (1) nature is good for wellbeing (1)
- Exposed rocks have been quarried (1) bringing money and jobs to the area (1) and useful materials for building (1)
- A Salt House was built in the past (1) useful minerals (1) bring jobs / money to the area (1)
- Give credit for grid references locating features or tourist facilities (up to 1 mark).

Credit any other valid points.

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(b) Examine the importance of cliff erosion in the supply of sediment to the coastal system.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	5			3			**8**

Indicative content

AO1
This encompasses knowledge and understanding of inputs to the coastal system. The content may include:

- The coastal system comprises inputs, transfers, stores and outputs of energy and materials.
- Sources of sediment include rivers, cliff erosion, marine (offshore) and longshore drift.
- Cliff erosion contributes significant amounts of sediment.
- Events such as a cliff collapse or storm conditions with destructive waves may cause a sudden input of large amounts of sediment.
- Rivers are another source of sediment, which is transported from inland. Weathering, river erosion, wind and ice all loosen material which is transported to the coast by rivers.
- Longshore drift may be a source in areas where prevailing wind is at an angle.

AO2
AO2 content encompasses the application of knowledge and understanding to examine the importance of wave erosion in the supply of sediment to the coastal system. Approaches may include:

- An examination of the importance of cliff erosion e.g.in areas of high energy waves and / or weak cliffs, cliff erosion may become the main source of sediment.
- An examination of the relative importance of other sources of sediment in different areas e.g. rivers are generally the main source of sediment to the coastline. Longshore drift may be the main source in areas where prevailing wind is at an angle and there is an ample supply of sediment further up the coast. In areas where sea defences stop or slow down erosion this source can be diminished or removed from the system.
- An examination of the different types of sediment e.g. sources of sediment may be human (beach replenishment) but are predominantly natural. On a local scale where beach replenishment occurs human activity can also be a significant source.
- An examination of changes over time e.g. in summer / calm conditions constructive waves push sediment onshore whereas in stormy / winter conditions destructive waves pull sediment offshore, therefore the amount of sediment from offshore fluctuates greatly.

Marking guidance

At the lower end of AO2, candidates may comment on the importance of cliff erosion e.g. it is an important input / the main factor affecting sediment supply to the coast.

At the higher end of AO2, candidates may comment on the relative importance of cliff erosion compared to other sources or may comment on the scale of impact of changes in weather and climate / human activity.

The indicative content is not exhaustive, other valid approaches should be credited.

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	AO1 (5 marks)	AO2.1c (3 marks)
Band	*Demonstrates knowledge and understanding of sources of sediment to the coastal system.*	*Applies knowledge and understanding to examine the role of cliff erosion as a source of sediment to the coastal system.*
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 cliff erosion and the coastal system. Demonstrates detailed and accurate knowledge and understanding of other sources of sediment to the coastal system. Well annotated sketches / diagrams / maps may also be used and should be credited.	**3 marks** Applies knowledge and understanding to produce a thorough and coherent examination that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent examination of the importance of cliff erosion as a source of sediment to the coastal system.
2	**2-3 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and well-developed examples. Demonstrates accurate knowledge and understanding of cliff erosion and the coastal system. Demonstrates accurate knowledge and understanding of other sources of sediment to the coastal system. Sketches / diagrams / maps may also be used and should be credited.	**2 marks** Applies knowledge and understanding to produce a coherent but partial examination that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial examination of the importance of cliff erosion as a source of sediment to the coastal system.
1	**1 mark** Demonstrates limited knowledge and understanding through a limited number of undeveloped examples. Demonstrates limited knowledge and understanding of cliff erosion and the coastal system. Demonstrates limited or no knowledge and understanding of other sources of sediment to the coastal system. Basic sketches / diagrams / maps may be used and can be credited.	**1 mark** Applies knowledge and understanding to produce an examination with limited coherence and support from some evidence. Applies knowledge and understanding to produce a limited examination of the importance of cliff erosion as a source of sediment to the coastal system.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

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2. (a) (i) Use **Figure 2a and 2b** to describe changes in the area shown.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid change identified.					5		**5**

Indicative content

- The coastline has retreated / eroded / is further inland
- The section of coastline to the east of Happisburgh has eroded back furthest by 50m (25m is slowest rate of retreat)
- Roads / access routes have disappeared / eroded away since 1999
- Happisburgh lighthouse is now 50m closer to the coastline
- A caravan park on the coast is no longer evident in 2019 (1) current caravan park is 200m inland (1) away from the coastline to the north-east of Happisburgh (1)
- Farmland is now being used for caravans (change in land use)
- Farmland at the coast looks like it has been left to nature / uncultivated by 2019
- Farmland has been lost
- A few buildings have been lost to the east of Happisburgh (1)

Credit other valid points. Candidates may address changes by way of comparison, but comparative statements are not necessary to gain marks.

(ii) Suggest why groynes have been constructed in this area.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
			3				**3**

This question tests the candidates' ability to apply their knowledge to the area shown.

Indicative content

- Coastline is managed because this area has caravans and is therefore a tourist destination (1) tourists will want a beach / tourist economy relies on the presence of a beach (1)
- Cheaper than sea walls and revetments (1) the land in the photos is not of high enough value to justify a sea wall (1)
- There is loss of land due to erosion / longshore drift (1) groynes will help to combat this (1)
- No presence of rock at the coastline means it is easily eroded (1) groynes slow down longshore drift/transportation processes (1) and help build the beach (1).

Credit any other valid points.

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(b) Examine the role of geological factors in determining the rate of erosion at a coastline.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	5			3			**8**

Indicative content

AO1
This encompasses knowledge and understanding of factors that affect the rate of wave erosion.

- Geological factors include lithology (rock type, hardness and solubility), and structural geology (bedding, dip, joints, folding and faulting).
- Hard rock with low solubility is more resistant than soft and / or soluble rock.
- Some coastlines may have low cliffs made of sediment / glacial till which will be extremely weak.
- Bedding planes and joints are weaknesses and therefore wave erosion is faster and leads to formation of caves and arches.
- Sedimentary rocks have bedding planes between rock layers and limestone is jointed and soluble.
- Igneous and metamorphic rock is much more resistant to erosion.
- Folding and faulting creates joints (weaknesses) and if bedding planes slope into the sea, mass movement is likely.
- Other factors affecting rates of erosion are fetch, degree of shelter from prevailing winds, wind speeds which vary in time and space, wave type and reflection / refraction.

AO2
AO2 content encompasses the application of knowledge and understanding to examine the role of geological factors in determining the rate of wave erosion. Approaches may include:

- An examination of how two areas of similar geology may be affected by different wave types. High energy waves with long fetch will erode more quickly than low energy / sheltered coastlines (spatial variation).
- An examination of how two areas with the same fetch may have different geology. Jointed or softer rocks / clay cliffs will erode more quickly than harder rock types.
- An examination of seasonal changes in wind speed and direction mean that wave energy may become more or less important at different times during a year.
- An examination of the relative importance of other factors e.g. refraction increases rates of erosion around promontories and causes deposition within bays / inlets. This is a significant influence on processes occurring and rates of erosion along a given coastline. The relative importance of each factor will vary from place to place.

Marking guidance

At the lower end of AO2, candidates may comment on the importance of geological factors in determining rates of erosion e.g. geological factors are an important influence / the main influence / not the main influence.

At the higher end of AO2 candidates may comment on the relative importance of geological factors in relation to other factors. Candidates may also comment on the inter-relationships between the different factors.

The indicative content is not exhaustive, other valid approaches should be credited.

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	AO1 (5 marks)	AO2.1c (3 marks)
Band	*Demonstrates knowledge and understanding of factors affecting rates of erosion at the coastline.*	*Applies knowledge and understanding to examine the relative importance of geological factors in determining rates of erosion at the coast.*
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 at least two geological factors affecting rates of erosion at the coast. Well annotated sketches / diagrams / maps may also be used and should be credited.	**3 marks** Applies knowledge and understanding to produce a thorough and coherent examination that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent examination of the relative importance of geological factors in determining rates of erosion at the coast.
2	**2-3 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and well-developed examples. Demonstrates accurate knowledge and understanding of two or more geological factors affecting rates of erosion at the coast. Sketches / diagrams / maps may also be used and should be credited.	**2 marks** Applies knowledge and understanding to produce a coherent but partial examination that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial examination of the relative importance of geological factors in determining rates of erosion at the coast.
1	**1 mark** Demonstrates limited knowledge and understanding through a limited number of undeveloped examples. Demonstrates limited knowledge and understanding of geological factors affecting rates of erosion at the coast. Basic sketches / diagrams / maps may be used and can be credited.	**1 mark** Applies knowledge and understanding to produce an examination with limited coherence and support from some evidence. Applies knowledge and understanding to produce a limited examination of the role of geological factors in determining rates of erosion at the coast.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

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Or: Glaciated Landscapes

3. (a) (i) Use **Figure 3a** to state the six-figure grid reference of the summit of Pen yr Ole Wen (X).	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					1		**1**

Acceptable answers:

- 656619 (accept +/- 1 either way e.g. 655618)

3. (a) (ii) Use **Figure 3a and Figure 3b** to give the direction in which the camera was facing when the photograph was taken.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					1		**1**

Acceptable answers:

- NE
- NNE

3. (a) (iii) Use **Figure 3a** and the **Resource Folder** to describe the characteristics of the cirque at Cwm Idwal.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid point**.**					3		**3**

Indicative content

- The cirque is facing north-east (NE) / north north-east (NNE) (1) Steep back wall to the south (1) Contours are very close together which indicates a steep back wall (1)
- There is an elongated / linear lake in the cirque (1) Flows out of the cirque to the NE / into Llyn Ogwen (1) There are streams / tributaries leading into the lake. (1)
- Cirque is long and narrow rather than typical circular shape (1) Around 800m long (1) 300m wide (1)
- Steep sided on three sides (1) contours close together (1) gentler slopes where lake drains out towards NE (1) steeper on the east flank compared to the west (1)
- Credit any grid references used
- Credit any distance or area calculations
- Credit any mention of the height of the cirque.

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(iv) Suggest **one** way in which the glaciated landscape in **Figures 3a and 3b** could have a positive impact on human activity**.**	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for stating a positive impact and up to two marks for development.		3					**3**

This question tests the candidates' ability to apply their knowledge to the area shown on the map.

Indicative content

- Good for wellbeing or local businesses (1) as there are footpaths and tracks (1) would be popular due to beautiful scenery (1)
- The landscape is steepened which allows outdoor pursuits (1) hiking (1) climbing (1) hang gliding (1) businesses created to offer these activities (1)
- The lake could be used for swimming (1) fishing (1) opportunities for recreation and enjoyment (1)
- There are nature reserves / national trust areas in this landscape (1) helps to preserve wildlife and scenic value (1) for people to enjoy (1) learn about nature (1)
- The landscape attracts tourists (1) there are hostels and campsites in the area (1) generating income (1) providing work (1) in an area which is otherwise undeveloped (1)
- Any use of grid references to locate features should be credited (max 1 mark).

Credit any other valid points.

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(b) Examine the importance of winter precipitation to mass balance in a glacier system.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	5			3			**8**

Indicative content

AO1
This encompasses knowledge and understanding of inputs to the glacial system. The content may include:

- The glacial system comprises inputs including precipitation, flows and outputs
- Mass balance refers to the gain and loss of ice from the glacier system
- If there is more input of snow compare to loss from ablation, the glacier will grow / advance. If there is less input of snow compared to loss from ablation, the glacier will shrink / recede
- Other factors that affect the glacial system are temperatures throughout the year and over time, sublimation, albedo and feedback loops, windblown snow and avalanches.

AO2
AO2 content encompasses the application of knowledge and understanding to examine the importance of winter precipitation as an input to the glacial system. Approaches may include:

- An examination of winter as typically the season of accumulation of snow, which maintains the glacier (and therefore mass balance) across a year. In summer, precipitation is lower, or may be rainfall, and ablation is dominant as temperatures rise
- An examination of how increasingly, due to climate change, winter precipitation may also fall as rain, the number of snow days decreasing in many areas. This reduces the input of snow and the balance between accumulation and ablation is changed and mass balance is reduced
- An examination of how changing temperatures due to climate change will play a significant role in disturbing equilibrium and causing glaciers to recede. Even with no change in winter precipitation, rising temperatures increases ablation and glaciers recede, reducing mass balance
- An examination of other factors contributing to mass balance e.g. in some areas windblown snow and avalanches can add snow to the glacier, which will turn to ice, this is sporadic and a less reliable input than seasonal precipitation
- An examination of how feedback loops play a significant role in mass balance – if ice cover decreases, the albedo also decreases. More heat is absorbed, and ablation increases further, reducing mass balance.

Marking guidance

At the lower end of AO2 candidates may comment on the importance of winter precipitation e.g. it is an important input / the main factor affecting mass balance / glacier size.

At the higher end of AO2 candidates may comment on the relative importance of winter precipitation compared to other factors affecting the system or comment on the changing nature of winter precipitation globally and its effect on mass balance.

The indicative content is not exhaustive, other valid approaches should be credited.

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Award the marks as follows:		
	AO1 (5 marks)	**AO2.1c (3 marks)**
Band	*Demonstrates knowledge and understanding of the glacial system.*	*Applies knowledge and understanding to examine the importance of winter precipitation to the glacier system.*
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 the glacier system and mass balance. Well annotated sketches / diagrams / maps may also be used and should be credited.	**3 marks** Applies knowledge and understanding to produce a thorough and coherent examination that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent examination of the importance of winter precipitation to the glacier system.
2	**2-3 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and well-developed examples. Demonstrates accurate knowledge and understanding of the role of the glacier system and mass balance. Sketches / diagrams / maps may also be used and should be credited.	**2 marks** Applies knowledge and understanding to produce a coherent but partial examination that is supported by some evidence. Applies knowledge and understanding to produce a coherent but partial examination of the importance of winter precipitation to the glacier system.
1	**1 mark** Demonstrates limited knowledge and understanding through a limited number of undeveloped examples. Demonstrates limited knowledge and understanding of the glacier system and mass balance. Basic sketches / diagrams / maps may be used and can be credited.	**1 mark** Applies knowledge and understanding to produce an examination with limited coherence and support from some evidence. Applies knowledge and understanding to produce a limited examination of the importance of winter precipitation to the glacier system.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

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4. (a) (i) Use **Figure 4a and Figure 4b** to describe changes in the area shown.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid change identified.					5		**5**

Indicative content

- The Tschierva glacier has retreated further up the valley (1) is thinner (1)
- The front/snout of the glacier has retreated (1) from an altitude of 2100m to 2600m / retreated c. 500m upslope (1)
- Less snow is accumulated on the highest peaks (1)
- More vegetation present at lower levels in 2022 (1) any description of location (1)
- Tributary glacier has also retreated to leave a glacial lake (at 2180m) that was not there in 1935 (1)
- Lateral moraines are bigger in 2022 (1)
- A narrow glacial stream is present at the snout of the glacier (2300m) in 2022 (1).

Credit other valid points. Candidates may address changes by way of comparison, but comparative statements are not necessary to gain marks.

(ii) Suggest why rapid mass movement may occur in this area.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid point.			3				**3**

This question tests the candidates' ability to apply their knowledge to the area shown.

Indicative content

- There are exposed rocks which are vulnerable to freeze thaw weathering in this cold environment (1)
- Loosened rocks / joints and cracks widened (1) likely to fall suddenly under the influence of gravity (1)
- Very steep / over steepened slopes (1) means that gravity exerts force on the loosened rocks (1)
- Glacier has retreated so that it can no longer support the slope (1)
- Increased temperatures mean more water is present to act as a lubricant (1)
- Chemical weathering in the joints as temperatures have risen makes slope unstable (1)
- Credit 1 mark for naming a valid rapid mass movement process e.g. rockfall, slumping.

Credit any other valid points.

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(b) Examine the role of freeze-thaw weathering in the formation of **one or more** periglacial landforms. Content: 1.2.7, 1.2.8	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	5			3			**8**

Indicative content

Candidates should demonstrate knowledge and understanding of the significance of freeze-thaw weathering in contributing to the formation of periglacial landforms. Periglacial is a term used to represent a wide range of different high-latitude and high-altitude environments, which may or may not contain glaciers. Responses may include knowledge and understanding of:

AO1

- Freeze-thaw weathering occurs when rocks are porous (contain holes) or permeable (allow water to pass through). Freeze-thaw weathering (frost shattering) is caused by the physical force of water freezing in cracks and joints in the rock and then expanding by up to 9%, so wedging rocks apart to form angular debris
- Exposed rock will be subject to freeze-thaw weathering where temperatures fluctuate above and below 0˚C, so both altitude and aspect are important
- On steep slopes, exposed rocks are loosened when they are subject to freeze-thaw weathering in repeated cycles. When the weight of the weathered rock overcomes friction, then rockfalls (rapid mass movement) can occur at the base of the slope to form scree. Material in the upper part of the scree slope is highly unstable, whilst settling and weathering give lower angles at the slope foot.
- On steep slopes, the formation of pro-talus ramparts requires the existence of long-lived snow banks below rock cliffs. Freeze-thaw weathering leads to rockfall from the cliff and the blocks slide, bounce, avalanche or roll down the snow slope to accumulate at its base. Different marginal positions of the snow bank can produce multiple ridges of material
- In flatter areas (plateau surfaces), blockfields develop where freeze-thaw breaks up rock in situ. Blockfields are accumulations of angular, frost-shattered rock which pile up on plateau surfaces
- Freeze-thaw can weaken rocks beneath the snow in nivation hollows and cause slope failure at the back of the hollow. Freeze-thaw weathering can also occur along the edges of the depression creating loose material
- Head deposits are deposits of fragmented material which, following weathering, have moved downslope through a process of solifluction
- Freeze-thaw weathering can also impact the development of landforms created by glacial erosion processes e.g. continuing to modify the back wall of a cirque, forming scree slopes at its base.
- Knowledge and understanding of other influences on the formation and development of these landforms, including gradient and the nature of the geology / material in the landscape / aspect, should be credited.

AO2

AO2 content encompasses the application of knowledge and understanding to examine the role of freeze thaw weathering in the formation of glacial landforms. Approaches may include:

- An examination of the significance of freeze-thaw weathering in the formation of periglacial landforms
- An examination of the significance of location and / or season in determining rates of freeze-thaw weathering e.g. the process will not occur where / when temperatures are constantly below freezing
- An examination of the influence of other factors such as such as aspect, gradient or geology on the formation of the given landform(s) e.g. freeze-thaw weathering has different impacts on different gradients forming blockfields in flatter areas and scree/pro-talus ramparts in steeper areas.

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Marking guidance

Freeze-thaw weathering is highlighted in the specification and the process must be linked to a periglacial landform(s) to gain full AO1 credit. At the lower end of AO2, candidates may make basic/limited comments on the role of freeze-thaw weathering e.g. it has an important role.

At the higher end of AO2, candidates will address the question directly and may provide some judgement on the importance of freeze-thaw weathering in landform creation, compared to other factors. They may also comment on the role of freeze-thaw weathering seasonally / across different landscapes and geologies.

The indicative content is not exhaustive, other valid approaches should be credited.

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Award the marks as follows:		
	AO1 (5 marks)	**AO2.1c (3 marks)**
Band	*Demonstrates knowledge and understanding of frost weathering and the formation of peri-glacial landforms.*	*Applies knowledge and understanding to discuss the role of frost weathering in the formation of peri-glacial landforms.*
3	**4-5 marks** Demonstrates detailed and accurate knowledge and understanding of frost weathering and peri-glacial landforms. Well annotated sketches / diagrams / maps may also be used and should be credited.	**3 marks** Applies knowledge and understanding to produce a thorough and coherent analysis that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent examination on the role of frost weathering in the formation of peri-glacial landforms.
2	**2-3 marks** Demonstrates accurate knowledge and understanding of frost weathering and peri-glacial landforms. Sketches / diagrams / maps may also be used and should be credited.	**2 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 examination on the role of frost weathering in the formation of peri-glacial landforms.
1	**1 mark** Demonstrates limited understanding of frost weathering and peri-glacial landforms. Sketches /diagrams / maps may be used and can be credited.	**1 mark** 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 examination the role of frost weathering in the formation of peri-glacial landforms.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

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Section B: Tectonic hazards

5. (a) Use **Figure 5a** to describe variations in the likelihood of liquefaction.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					6		**6**

Indicative content

- Highest likelihood on the coast surrounding San Fransisco Bay (1)
- This band of high likelihood is 0.5 to 1.5km wide (1)
- A 7-8km wide band of medium likelihood (1) at San Jose / in SE of map (1)
- Linear sections of medium likelihood in NW area of map (1)
- Low likelihood on Pacific coast (1) to the West of the map (1)
- Likelihood is overall higher to the East of the tectonic margin compared to the west (1)
- There are large areas of very low likelihood west of the tectonic margin / SF bay (1) and in the NW of the map (1)

Credit any other valid points that describe pattern / variations.

(b) (i) Give the values for A and B in **Figure 5b.**	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
					2		**2**

Indicative content

A 8
B 36 (or -78 if calculated with formula in live paper)

(ii) Use **Figure 5b and Figure 5c** to comment on the nature and significance of the result of the Chi-squared test.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid point made.					4		**4**

Indicative content

Nature of relationship

- The softer sediment or rock experiences a higher intensity of ground shaking (1)
- The harder rock experiences a lower intensity of ground shaking (1)
- Different geologies experience different intensities of ground shaking (1)
- Quantification (1)

Significance

- Chi squared result shows a significant difference between intensity of ground shaking on different geology (1)
- Chi squared result is higher than the critical value of 9.21 but less than 13.82 therefore significant at 99% level (1)
- Therefore, there is a difference in the amount of shaking for different geologies 99% of the time (1) OR the null hypothesis can be rejected (1) with 99% confidence (1).

Pupils must comment on both the significance AND the nature of the relationship for four marks. Max 3 marks for dealing with one aspect only.

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5. (c) Outline the secondary effects of a named earthquake event. Content: 1.3.3	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	8						**8**

Indicative content

The indicative content is not prescriptive, and the candidate is not expected to cover all points for full marks. Answers will be dependent on case study chosen but may include:

- Tsunami. Displacement of water by an earthquake causes a swell which may only be 1m offshore. When shallower water is reached wave height increases rapidly. The built environment can be devastated by the wall of water that washes inland
- Landslides. Loose material on slopes or weakened rock faces can become dislodged and fall downslope during or after an earthquake. This is hazardous to human life and may block access routes or crush buildings. Rivers can be dammed and lead to flood events later when breached. Landslides collapsing into water bodies can also trigger large waves of water like tsunami and cause flooding
- Avalanche. Avalanches are caused when vibrations disturb a snowpack. They travel downslope at high speed and can engulf people or settlements
- Fires. Ruptured gas mains and broken electricity pylons can cause explosions and fires after an earthquake
- Liquefaction and associated effects on landscape and built environment
- Spread of disease where rescue is not possible for days or weeks
- Wider social, economic and environmental secondary effects e.g. economy collapse, social impacts e.g. homelessness and disease, water pollution etc.

Marking guidance

Do not credit primary impacts or drift of discussion into long-term recovery effort.

	AO1
Band	*Demonstrates knowledge and understanding of the impacts of an earthquake event.*
3	**6-8 marks** Demonstrates accurate knowledge and understanding of at least two secondary impacts of a named earthquake event. Demonstrates accurate knowledge and understanding through the use of an appropriate and well-developed example. Well annotated maps / sketches / diagrams may also be used and should be credited.
2	**4-5 marks** Demonstrates mostly accurate knowledge and understanding of secondary impacts of a named earthquake event. Demonstrates mostly accurate knowledge and understanding through the use of an appropriate example, which may not be fully developed. Generalised maps / sketches / diagrams may also be used and should be credited.
1	**1-3 marks** Demonstrates limited knowledge and understanding of secondary impacts of a named earthquake event. Demonstrates limited knowledge and understanding through the use of an example, which is undeveloped. Basic maps / sketches / diagrams may also be used and can be credited.
	0 marks Response not creditworthy or not attempted.

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6. (a) Use **Figure 6a** to describe the path of the 2002 lava flows from Mount Nyiragongo.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid point made.					2		**2**

- Mainly travelled south (1) towards Goma (1)
- Shorter flow to north-west / and to east (1)
- Two lava flows through Goma (1) one in the centre and one to the east (1)
- Lava took a winding path (1)
- One flow reached Lake Kivu (1)

Credit any other valid responses.

(b) Use **Figure 6b** to describe the distribution of areas of **high** social vulnerability to volcanic eruptions.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
Award one mark for each valid point made.					5		**5**

- General trend is for increasing vulnerability towards the North and North-west of Goma (1)
- Largest area of high vulnerability is in the North West / (Mugunga) (1)
- Linear pattern across the North of Goma (1) along Northern and Western edge of Goma (1)
- An area of high vulnerability 2km x 3km in the North West (1)
- Two areas on coast of Kivi lake in the west of the map (1)
- Other high areas are in the North of Goma, in Karisimbi (1)
- An area in east (1) / in Bujovu (1) / on border with Rwanda in North of Goma (1).

Credit any other valid responses. Maximum 2 marks for listing place names showing high levels of social vulnerability.

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(c) Use **Figure 6a and Figure 6c** to suggest **physical** reasons why it is difficult to manage the risk from future eruptions of Mount Nyiragongo.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
			9				**9**

Indicative content

Candidates are expected to interpret and analyse the resources and focus on physical factors. Answers should use the information to suggest why it is difficult to manage the risk from future eruptions of the volcano. Answers may include:

- **Figure 6a** shows that Goma City is regularly in the path of the lava flows, this being the case in 1977 and 2002 and 2021. It is likely that future lava flows will follow the same path
- **Figure 6a** shows that a number of volcanic cones surround the mountain and city. This may suggest that future eruptions may affect different areas
- **Figure 6a** shows that Goma City lies in close proximity to Mount Nyiragongo. It only lies 16km to the north meaning that future eruptions may continue to affect Goma City and may be more devastating than previously seen
- **Figure 6c** explains that the lava moves very quickly. It is difficult to run away from, divert or slow down / stop runny lava. Runny lava is of a very high temperature and the risk of landscapes and properties burning in proximity to the lava flow is high
- **Figure 6c** suggests that a large volume of lava erupts. This means that the areal extent of the risks is large and that a significant depth of lava covers the land areas affected e.g. in 2002 lava in parts of Goma City was 2m deep
- Explosions can occur when lava mixes with water (Lake Kivu – **Figure 6a**) which can be deadly. Toxic gases are also emitted which can kill people and wildlife (**Figure 6c**).
- The frequency of eruptions and the range and nature of hazards associated with this volcano may make it difficult to manage in future.

	AO2.1b (9 marks)
Band	*Demonstrates ability to interpret and analyse the maps and evidence in **Figures 6a and 6c** to show understanding of the difficulties in managing risks from volcanic eruption.*
3	**7-9 marks** Demonstrates detailed and accurate interpretation of the resources to outline the difficulties in managing the risk of future volcanic eruptions.
2	**4-6 marks** Demonstrates accurate interpretation of the resources to outline the difficulties in managing the risk of future volcanic eruptions.
1	**1-3 marks** Demonstrates limited interpretation of the resources to outline the difficulties in managing the risk of future volcanic eruptions.
	0 marks Response not creditworthy or not attempted.

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(d) **Use Figure 6b and Figure 6c** to examine different **human** factors affecting vulnerability to volcanic eruptions.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		Total
				10			**10**

Indicative content

This question requires students to apply their knowledge and understanding of factors affecting vulnerability to volcanic eruptions.

- **Figure 6b** shows medium to high social vulnerability across much of Goma city. People in those areas, particularly the north-west of Goma city, have poor housing, low levels of education and low income.
- Many residents of those areas are unlikely to be well informed about plans for evacuation, rescue and relief in an LEDC. They may not own radios, TVs, mobile phones etc.
- It is difficult to teach people how to protect themselves if education is poor.
- People's perception of the risk will be unrealistic with limited education or experience of eruptions, and they may not prepare effectively. The North-west of Goma city was not hit by the lava flow in 2002.
- Areas with better access to education, or experience of the effects of a lava flow will be better prepared (central and eastern Goma city).
- Poor housing will not offer protection against lava flows.
- Low GDP of $500 per capita per year means that Government struggle to pay for protection measures such as barriers to lava flows.
- **Figure 6c** shows that refugees in the country will increase the number of people with substandard housing.
- Areas of the city with higher income will have stronger housing, with potentially less damage.
- Areas of the city with higher income will be more resilient and able to rebuild and recover.
- Low levels of education and housing result in low resilience – people's ability to recover from a disaster is low.
- Low levels of GDP per capita mean that the country also has low resilience and is reliant on aid to recover after a disaster.
- Access to health care is limited in developing countries, disease and death after disaster will be high.
- **Figure 6c** shows that civil unrest means that monitoring the volcano is very difficult. Scientists are in danger of attacks and equipment is not maintained. Changes in the volcano would be difficult to notice / monitor. Visiting the volcano to judge activity is risky. This means effective warnings are not able to be given. Evacuation is not possible without warnings.

This is not exhaustive – accept any other valid points that are relevant to the resource. The answers given should relate clearly to Goma city.

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	AO2.1c (10 marks)
Band	*Applies knowledge and understanding to discuss how human factors influence vulnerability in Goma city.*
3	**7-10 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 of how *human factors influence* vulnerability in Goma city.
2	**4-6 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 of how *human factors influence* vulnerability in Goma city.
1	**1-3 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 of how *human factors influence* vulnerability in Goma city.
	0 marks Response not creditworthy or not attempted.

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7. (a) Examine the effectiveness of prediction as a response to volcanic hazards.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	5			3			**8**

Indicative content

AO1
AO1 content encompasses knowledge and understanding of prediction and other hazard management strategies in relation to differing volcanic hazards. Approaches may include:

- Prediction is part of the hazard management cycle, the result of monitoring it is intended to help places prepare for volcanic eruption
- Monitoring includes measuring surface temperature, gas emissions, ground deformation, earthquake activity. Changes can indicate an imminent eruption
- Scientists can predict likely eruption and declare different levels of alert e.g. yellow alert when activity is increasing, red alert to show high likelihood of eruption
- Prediction allows places to issue warning and tell people how to act / organise defences such as diverting lava flows, or evacuation of settlements at risk
- Hazard maps based on knowledge of previous eruptions and data from monitoring can be drawn up to predict areal extent of risks
- Hazards such as pyroclastic flows and lahars can be predicted from past activity and deposits left from past eruptions
- Knowledge and understanding of other response strategies relating to volcanic hazards e.g. mitigation and/or warning strategies in the context of different hazards/locations.

AO2
AO2 content encompasses the application of knowledge and understanding in order to examine the effectiveness of responses to volcanic hazards. Approaches may include:

- An examination of the significance of successful prediction leading to warning, emergency preparations and/or evacuation
- An examination of the significance of other elements of hazard management cycle as without mitigation and rescue there would be more deaths
- An examination of how some volcanoes and/or associated hazards can be more difficult to predict than others
- An examination of how few volcanoes maintain the same behaviour for long so makes prediction difficult and/or inaccurate
- An examination of how the success of prediction varies from one place to another and can be influenced by economic and political factors. Inaccurate forecasts can undermine residents' confidence in future forecasts and therefore diminish their effectiveness in the longer-term.

At the lower end of AO2, candidates may evaluate the effectiveness of prediction in a straightforward way e.g. prediction is very effective.

At the higher end of AO2, candidates may critically evaluate why the effectiveness of prediction may vary between volcanoes and / or over space e.g. prediction has been effective in some cases, but other eruptions are more difficult to predict accurately.

Credit any other valid points.

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	AO1 (5 marks)	AO2 (3 marks)
Band	*Demonstrates knowledge and understanding of volcanic hazard management strategies.*	*Applies knowledge and understanding to discuss the effectiveness of prediction as a response to volcanic hazards.*
3	**4-5 marks** Demonstrates accurate knowledge and understanding of prediction as a response to the threat of volcanic hazards. Demonstrates accurate knowledge and understanding through the use of an appropriate and well-developed example. Well annotated maps / sketches / diagrams may also be used and should be credited.	**3 marks** Applies knowledge and understanding to produce a thorough and coherent examination that is supported by evidence. Applies knowledge and understanding to produce a thorough and coherent examination of the effectiveness of prediction as a response to volcanic hazards.
2	**2-3 marks** Demonstrates mostly accurate knowledge and understanding of prediction as a response to the threat of volcanic hazards. Demonstrates mostly accurate knowledge and understanding through the use of an appropriate example, which may not be fully developed. Generalised maps / sketches / diagrams may also be used and should be credited.	**2 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 examination of the effectiveness of prediction as a response to volcanic hazards.
1	**1 mark** Demonstrates limited knowledge and understanding of prediction as a response to the threat of volcanic hazards. Demonstrates limited knowledge and understanding through the use of an example, which is undeveloped. Basic maps / sketches / diagrams may also be used and can be credited.	**1 mark** 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 examination of the effectiveness of prediction as a response to volcanic hazards.
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

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(b) Outline the tectonic processes operating at diverging plate margins.	AO1	AO2.1a	AO2.1b	AO2.1c	AO3		**Total**
	10						**10**

Indicative content

Candidates are required to go beyond description of landforms in order to fully explain the processes operating.

AO1

- Molten material wells up at diverging plate margins because of the thinning of the lithosphere, and the consequent decrease in pressure results in partial melting of the upper mantle. As the lithosphere is heated, it rises and becomes elevated above the surrounding sea floor to form an ocean ridge. This elevation produces a slope down and away from the ridge. Fresh rock formed at the spreading centre is relatively hot, less dense and more buoyant than the rock further away, which becomes increasingly older, cooler and denser. Gravity acts on this older, denser lithosphere, causing it to slide away from the spreading ridge. This process is known as ridge push and is accepted to be the active force driving plate movement
- Diverging convection currents in the mantle contribute to plate movement and rifting of the crust
- Rifting creates rift faults parallel to the margin as the crust is stretched. Central portions of the crust, being unsupported, may drop to create rift valleys
- As pressure is released on the mantle, lava erupts along fissures or through shield volcanoes.
- Pressure reduction on the mantle causes some minerals to melt (pressure melting) and basaltic lava erupts
- New lithosphere is created / sea floor spreading as the lava cools and solidifies.
- Dense, basaltic rock is formed, creating new sea floor
- Basaltic lava is more fluid and not explosive. It therefore builds layers of magma to form shield volcanoes
- Transform faults are created perpendicular to the margin as rates of movement along the margin are not even
- Earthquakes may occur as the crust moves through ridge push
- Diagrams may be used but must address the question and ***explain*** the processes.

Credit any other valid points.

Marking guidance

If a candidate response discusses converging or transform plate boundaries, credit to a max. of 3 marks.

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	AO1 (10 marks)
Band	*Demonstrates knowledge and understanding of process operating at diverging plate margins.*
3	**7-10 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 processes operating at divergent plate margins. Well annotated sketches / diagrams / maps may also be used and should be credited.
2	**4-6 marks** Demonstrates accurate knowledge and understanding through the use of appropriate and developed examples. Demonstrates accurate knowledge and understanding of the processes operating at divergent plate margins. Sketches / diagrams / maps may also be used and should be credited.
1	**1-3 marks** Demonstrates limited knowledge and understanding through a limited number of underdeveloped examples. Demonstrates limited understanding of the processes operating at divergent plate margins. Sketches /diagrams / maps may be used and can be credited.
	0 marks Response not creditworthy or not attempted

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