
A-level
GEOGRAPHY
7037/1

Paper 1 Physical geography

Mark scheme

June 2024

Version: 1.0 Final



Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from [aqa.org.uk](https://www.aqa.org.uk)

Copyright information

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Copyright © 2024 AQA and its licensors. All rights reserved.

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the typical performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

The notes for answers provide indicative content. Students' responses may take a different approach in relation to that which is typical or expected. It is important to stress that examiners must consider all a student's work and the extent to which this answered the question, irrespective of whether a response follows an expected structure. If in doubt the examiner should contact their team leader for advice and guidance.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Section A

Question 1 Water and carbon cycles

Qu	Part	Marking guidance	Total marks
01	1	Outline how human factors impact upon the water cycle. <u>Point marked</u> Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: <u>Notes for answers</u> • Deforestation / land clearance will typically reduce transpiration (depending on how the land use changes) (1). Some may point to increased runoff due to the lack of interception (1). This may lead to increased likelihood of flooding (1) (d). • Infiltration / percolation rates will also be reduced if natural vegetation is cleared (1). This is as a result of soil compaction (1) (d). • Global warming may increase the amount of precipitation in the atmosphere leading to even more intense downpours (1). • Global warming may also lead to desertification reducing precipitation even further from already low rates in those affected parts of the world (1). • Other human activity such as dam building will have a clear role in disrupting the discharge of a river, creating flooded river valleys as human-made lakes form (1). • Effects of urbanisation mean there is less infiltration due to impermeable surfaces (1) Max 3 for only one factor. Max 1 for a list of factors without any development The notes for answers are not exhaustive. Credit any valid points.	4 AO1=4
01	2	Analyse the data shown in Figure 1a and Figure 1b. AO3 – There should be clear analysis of the relationships evident in the resources. Analysis should consider the connections evident in the data eg between latitude and temperature trends. <u>Mark scheme</u> Level 2 (4–6 marks) AO3 – Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. Level 1 (1–3 marks)	6 AO3=6

		AO3 – Basic analysis of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence. <u>Notes for answers</u> AO3 - Between 40–60° north there appears to be a substantial increase in temperature with extremes approaching perhaps 1.25 °C increase. - Equally there is a significant anomaly in the data at around 45° north with a 0.75 °C decrease in temperature. - It is important to note that there are a substantial number of lakes experiencing minimal change across latitudes. - There appears to be a concentration of lakes experiencing more extreme temperature variation in northern and eastern Europe. - The data within the dataset is also significant at –0.75 to +1.25 ie a 2 °C variation. - Data may be affected by number of recording stations across different parts of the globe ie more data in the northern hemisphere almost certainly due to there being more lakes and therefore recording stations. Credit any other valid analysis.	
--	--	--	--

01	3	Using Figure 2 and your own knowledge, assess factors affecting the likelihood of flooding across the UK. AO1 – Knowledge and understanding of the causes of flooding. AO2 – Application of knowledge and understanding to assess the implications of the data on the likelihood of flooding issues. <u>Mark scheme</u> Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.	6 AO1=2 AO2=4
----	---	--	---

		<u>Notes for answers</u> AO1 • Changes in the water cycle over time to include natural variation including storm events, seasonal changes and human impact including farming practices, land use change and water abstraction. • Concept of water balance. • Runoff variation and the flood hydrograph. • Changes in the water cycle over time to include natural variation including storm events. • The impact of precipitation upon drainage basin stores and transfers and implications for flooding. AO2 • The data represents river flow in November 2019. It implies that rainfall must have been very high in the preceding hours / days across large swathes of England. This is due to the lag time between rainfall events and the impact on the hydrograph. • Clearly flooding is highly likely across the whole of south-west, central and northern England. Even in the south-east, there are also instances of notably high rainfall. • In assessing the likelihood of flooding, contributory factors will need to be considered. These are likely to include the weather at the time and whether more rain is forecast. More rainfall will almost certainly lead to increased levels of flooding given the situation in many parts of the UK on this day. Expect reference to the Midlands and north-west England for example. The levels of antecedent rainfall and how waterlogged the ground is in each location will affect the levels of infiltration, percolation and runoff, again affecting the likelihood of flooding. The levels of urbanisation versus farmland/woodland affect runoff speeds. East Anglia for example has normal river flow. This, combined with it being a rural region (mainly), suggests low flood risks. Typically, urbanisation increases runoff and should increase flood risk. However, looking at Greater London for example, river levels are generally normal. However these urban areas are more likely to be managed with flood prevention measures. This often counteracts and reduces the flood risk. • Credit any valid assessment eg precipitation in and around the Midlands is the most likely factor leading to flooding given how saturated the land must be. Credit any other valid assessment.	
--	--	---	--

01	4	With reference to a tropical rainforest that you have studied, evaluate attempts to mitigate the impacts of climate change. AO1 – Knowledge and understanding of a tropical rainforest case study. Awareness of attempts to mitigate the impact of climate change. AO2 – Application of knowledge and understanding to evaluate measures to mitigate the impact of climate change. <u>Notes for answers</u> AO1 • The carbon budget and the impact of the carbon cycle upon land, ocean and atmosphere, including global climate. • Factors driving change in the magnitude of carbon stores over time and space, including flows and transfers at plant, sere and continental scales. Photosynthesis, respiration, decomposition, combustion. • Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change. • Case study of a tropical rainforest setting to illustrate and analyse key themes in the carbon cycle and their relationship to environmental change and human activity. AO2 • For the chosen case study expect to see reference to the major forested areas such as Amazonia, Borneo, Malaysia or the Congo Basin. Others may consider specific schemes or locations in support of their responses eg recent reforestation schemes in north-east Australia. • As part of the introduction expect to see reference to evaluative comment around the issue of deforestation and its associated impact on climate. This is a valid approach as long as it does not dominate the response. • Most answers will focus on strategies such as reforestation, conservation measures, sustainable farming practices and sustainable development of the rainforest. Answers based on the Amazonas might refer to the following: • Farming co-operatives such as RECA have established profitable and sustainable agroforestry projects which maintain plantations which produce a range of products for sale across many industries in Brazil and around the world. Expect to see reference to the potential climate benefits this may bring. • Conservation strategies such as the Central Amazon Conservation Complex makes up the largest protected area in the Amazon Basin and is one of the planet's richest regions in terms of biodiversity. Not only will this preserve forest (mitigating climate change), there are also wider benefits to protecting species diversity. • One reforestation scheme in Amazonia aims to restore 73 million trees by 2023, spanning an area of 30 000 hectares. This is part of Brazil's Paris Agreement target of reforesting 12 million hectares of land by 2030. Expect to see positive evaluative comment in this regard.	20 AO1=10 AO2=10
----	---	--	--

		• A wider evaluation of measures impacting climate change on a global scale is creditworthy as long as there is some link to the TRF. • In evaluating the success of these strategies, expect to see reference to the significant challenges posed by illegal logging and political policy. In Brazil for example, there has been a 50% increase in deforestation as a direct result of government policy. Credit any other valid approach.	
--	--	---	--

Marking grid for Question 01.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	- Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). - Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). - Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). - Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). - Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	- Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2). - Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). - Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). - Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1). - Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	- Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places. - Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). - Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). - Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1). - Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	- Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2). - Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). - Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

	• Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Section B

Question 2 Hot desert systems and landscapes

Qu	Part	Marking guidance	Total marks
02	1	Outline characteristics of a pediment. <u>Point marked</u> Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: <u>Notes for answers</u> • Pediments are gently sloping erosional surfaces (1) formed at the base of a mountain front (1). • They are erosional features formed by the action of running water (1). • They are often covered by a thin layer of soil (1) which may be comprised of alluvium deposits (1) (d). • Other landforms may form in these landscapes such as inselbergs when differential erosion occurs (1). • Weathering may also play a part helping to maintain the gentle slope (1). • Wind erosion may also play a part in removing the thin soils and exposing the rock to ongoing weathering processes (1). The notes for answers are not exhaustive. Credit any valid points.	4 AO1=4
02	2	Using Figure 3a and Figure 3b, interpret the change in rainfall and vegetation patterns in central and north Africa. AO3 – Responses should interpret the evidence which demonstrates how rainfall patterns and natural vegetation cover has changed across central and north Africa. <u>Mark scheme</u> Level 2 (4–6 marks) AO3 – Clear analysis of a geographical issue or question. Clear evaluation of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. Level 1 (1–3 marks) AO3 – Basic analysis of a geographical issue or question. Basic evaluation of the quantitative and qualitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence.	6 AO3=6

	<u>Notes for answers</u> AO3 • In terms of rainfall, the main interpretation is that almost without exception, the continent has become drier. There are ample ways of exemplifying this such as the 250 mm isohyet which covered much of the modern day Sahara Desert around 6–10 000 years ago. Essentially each isohyet has moved further south, in some cases substantially. Another example is the >2000m isohyet. Some may connect this with the disappearance of the major lakes and alluvial fans eg the Megalake Chad appears to have all but disappeared. • In terms of vegetation, there is a clear connection between the changing rainfall and vegetation types. The most striking example of this is the emergence of the Sahara Desert itself. 6–10 000 years ago, there were just five pockets of deserts where rainfall appears to have been below 250mm. Now the desert covers almost the entire north of Africa from the east to the west, except for the small northern extent of Mediterranean and sub-Mediterranean vegetation, which has also shrunk. • Some may point to the connection between rainfall data and changing vegetation moving south. The grassland has moved into the previously wooded grassland, which itself has been pushed south into what was previously woodland. Forest has been pushed further to the south. • Calculations in terms of scale may also feature eg grassland use to occupy a north-south swathe of land at over 1000 km² but now only occupies around a few hundred square kilometres in places. Credit any other valid interpretation.	
--	---	--

02	3	Using Figure 4 and your own knowledge, assess the potential impact of desertification. AO1 – Knowledge and understanding of the process of desertification and the impact that this has. AO2 – Application of knowledge and understanding to the novel situation in order to assess the potential impact of desertification. <u>Mark scheme</u> Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance. <u>Notes for answers</u> AO1 • The causes of desertification – climate change and human impact; distribution of areas at risk; impact on ecosystems, landscapes and populations. Predicted climate change and its impacts; alternative possible futures for local populations. • Case study at a local scale of a landscape where desertification has occurred to illustrate and analyse key themes of desertification, causes and impacts, and implications for sustainable development. AO2 • The Aral Sea area is likely to disappear completely in the coming years. This will impact upon the aquatic food chains as well as local fishing communities. It will also affect the wider land-based food chain such as birds and mammals that previously fed on the fish. The land itself. The minerals and salts left behind (as a result of eluviation) will render the land impossible to cultivate. Wind-blown particles may also affect surrounding areas which were previously cultivable. • In places such as the Sahel, the US and Australia, the problems will be similar. The worsening climate issue is likely to affect food production with many facing famine as a result of increasingly severe droughts which will mean that crops cannot be grown. Without action to control the population growth and associated problems (illegal logging), the land will not be able to sustain the people. The link between deforestation and soil erosion is likely to feature in this regard.	6 AO1=2 AO2=4
----	---	---	---

		• In Amazonia, similar issues are likely to feature but also expect to see consideration of the impact on local ecosystems. Net primary productivity will fall, habitat loss will accelerate and soil erosion may cause permanent changes to the area's ability to sustain current levels of biodiversity. Credit any other valid assessment.	
--	--	--	--

02	4	With reference to one or more hot deserts that you have studied, assess potential impacts of climate change on the development of landforms. AO1 – Knowledge and understanding of a named hot desert and the landscape developments in desert regions. AO2 – Application of knowledge and understanding to a chosen case study assessing the potential role of climate change on the landscape. <u>Notes for answers</u> AO1 • Systems in physical geography: systems concepts and their application to the development of desert landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium. • Characteristics of hot desert environments and their margins: climate, soils and vegetation (and their interaction). Water balance and aridity index. • The concepts of landform and landscape and how related landforms combine to form characteristic landscapes. • Geomorphological processes: weathering, mass movement, erosion, transportation and deposition. • Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block and granular disintegration). • The role of wind – erosion: deflation and abrasion; transportation; suspension, saltation, surface creep, deposition. • Sources of water: exogenous, endoreic and ephemeral; the episodic role of water; sheet flooding, channel flash flooding. • Origin and development of landforms of mid and low latitude deserts: aeolian – deflation hollows, desert pavements, ventifacts, yardangs, zeugen, barchans and sief dunes; water – wadis, bahadas, pediments, playas, inselbergs. • The relationship between process, time, landforms and landscapes in mid and low latitude desert settings: characteristic desert landscapes. • Case study of a hot desert environment setting to illustrate and analyse key themes. AO2 • Expect to see responses set out in different scenarios in terms of how climate change is set to affect desert regions. Most agree that there will be a northward advance of sub-tropical deserts as a result of changes in atmospheric circulation (Hadley Cell). Hot deserts are essentially likely to become even hotter and even drier. • In terms of physical landscape development, there are many ways candidates might approach this element. Expect to see reference to how climate change has the potential to exaggerate certain processes and affect the formation of landforms within the desert landscape. • For example, increased wind speeds may increase the amount of deflation and accelerate the formation of deflation hollows and desert	20 AO1=10 AO2=10
----	---	---	--

		pavements. This increase in transport may be linked to a variety of dune formations. This may be connected to changing vegetation patterns ie that with less vegetation there is less barrier to transporting sand over greater distances. • Dust storms are potentially more likely as is aeolian erosion. This may be linked to yardang, zeugen and ventifact formation. • The rate of episodic flash flooding is likely to be reduced (depending on location) but when such events do occur, they are likely to be more extreme due to the baked surfaced on which the rain will fall. This may be linked to the development of wadis. • Consideration of temperature extremes may feature, particularly diurnal variations. This is likely to be linked to exfoliation and mechanical weathering. • Whatever the approach it should be clear that climate change is likely to have a significant impact on landscapes in what is already one of the most extreme and fragile environments on the planet. Any conclusion is acceptable, though should relate to preceding content.	
--	--	--	--

Marking grid for Question 02.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	- Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). - Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). - Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). - Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). - Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	- Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2). - Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). - Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). - Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1). - Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	- Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places. - Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). - Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). - Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1). - Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	- Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2). - Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). - Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

	• Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Question 3 Coastal systems and landscapes

Qu	Part	Marking guidance	Total marks
03	1	Outline the sequence in the development of a sea stack. <u>Point marked</u> Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: <u>Notes for answers</u> • They are often found along discordant coastlines where headlands and bays are formed. • The process starts with hydraulic action and abrasion by sea waves striking against a headland which carve out joints and bedding planes (1). • Over time the joint extends into a cave (1). • Once the cave breaks through the headland an arch is formed (1). This may also occur where two caves back onto each other (1) (d). • Blow holes occur in some circumstances as continued hydraulic action causes a breakthrough on the landward side of the cave (1). • Continued erosion and weathering of the arch roof and walls occurs until it collapses leaving behind a sea stack (1). • An example is Old Harry in Studland Bay on the Isle of Purbeck (1). Reserve final mark for arch collapsing to complete the sequence. The notes for answers are not exhaustive. Credit any valid points.	4 AO1=4

03	2	Analyse the data shown in Figure 5a and Figure 5b. AO3 – Responses should accurately interpret the map evidence and correlate this with the information provided in the two graphs. <u>Mark scheme</u> Level 2 (4–6 marks) AO3 – Clear analysis of a geographical issue or question. Clear evaluation of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. Level 1 (1–3 marks) AO3 – Basic analysis of a geographical issue or question. Basic evaluation of the quantitative and qualitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence. <u>Notes for answers</u> AO3 • Some may calculate the total length of coastline as basic data manipulation exercise (3261 km) from which percentages can then be calculated. • The southern area is most vulnerable to erosion according to the data with around 550 km of very high vulnerability. However, the rest is low (300 km). There may be some connection to the south-east and south-west coastlines in this regard. • There are very few areas with no vulnerability with only 193 km or around 6% of the total area. • Very high and high vulnerability totals 1140 km or 35% of Vietnam's coastline. • The length of coastline does correlate with any extreme levels of vulnerability eg south middle appears to be the longest coastline but has only 260 km of very high or high vulnerability. Around 1080 km have no low or medium vulnerability. Credit any other valid analysis.	6 AO3=6
----	---	--	-----------------------------------

03	3	Using Figure 6 and your own knowledge, assess potential approaches to managing this coastal region. AO1 – Knowledge and understanding of issues associated with human occupation of coastal landscapes. AO2 – Application of this knowledge to the novel situation; specifically in evaluating the human responses to these issues. <u>Mark scheme</u> Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance. <u>Notes for answers</u> AO1 - Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk: soft engineering. Sustainable approaches to coastal flood risk and coastal erosion management. - Case study of a contrasting coastal landscape beyond the UK to illustrate and analyse how it presents risks and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation. AO2 - The data suggests that the area under extreme pressure caused by human occupation, exploitation of natural resources, population growth and climate change. - Responses are likely to focus on the potential to better manage the area as well as cope more effectively with climate change. - Coastal management strategies will need to consider the relative poverty of the region. Outside help may be provided (UN or World Bank for example), but also the region will need to consider its own cost-effective potential solutions. Other areas of the world may provide ideas such as the Sundarbans or Odisha. Use of soft engineering solutions such as embankments, beach nourishment or mangrove planting could be attempted. At the very least, more needs to be done to stop any continued deforestation of mangrove.	6 AO1=2 AO2=4
----	---	--	---

		• The pollution issue is of particular concern. It is hard to see how this can be addressed without considerable investment in sewerage facilities and regulation of industrial effluent. • Overfishing could be tackled by more effective regulation and education for the fishing communities. • Some contingencies may be required in terms of relocating people away from the most threatened areas. • Other economic activity may feature in some responses. Tourism is one obvious way in which revenue could be generated whilst also conserving the local environment more effectively. • The scale of the challenge should not be underestimated. There are very large numbers of people concentrated in relatively small areas, under extreme pressure in the coming decades. Credit any other valid assessment.	
--	--	---	--

03	4	With reference to one or more coastal environments that you have studied, assess the potential impact of climate change on the development of landforms. AO1 – Knowledge and understanding of a local scale coastal case study. Knowledge and understanding of the predicted impact of sea level change. AO2 – Application of knowledge and understanding to assess the impact of climate change upon the chosen case study. <u>Notes for answers</u> AO1 • Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development. • Estuarine mudflat/saltmarsh environments and associated landscapes; factors and processes in their development. • Coastlines of emergence and submergence. Origin and development of associated landforms: raised beaches, marine platforms; rias, fjords, Dalmatian coasts. • Recent and predicted climatic change and potential impact on coasts. • Eustatic and isostatic sea level change. • Recent and predicted climatic change and potential impact on coasts. AO2 • Responses are likely to focus on the sea level change as a result of the warming atmospheric conditions. Expect to see the connection to increased flooding erosion as well as the episodic impact of extreme weather events. • Case studies such as Holderness in the UK contrasted with places such as the Maldives, Louisiana, Odisha or Kiribati are likely to feature in terms of exemplification. • Sea level rise will exacerbate the issues in already vulnerable locations. Holderness is likely to see even faster rates of erosion on its boulder clay cliffs for example. Places vulnerable to inundation by the sea are also likely to see more regular occurrences of such issues. • It is also reasonable to take a more theoretically physical approach and consider landform development. Landscapes dominated by erosion are likely to see further attack by coastal processes. Cliff collapse and retreat, development of wave cut platforms, and collapsing arches may all feature. • Weathering and mass movement may also be considered. • Management may be considered in terms of reducing the impact of climate change and associated coastal impacts. This is a legitimate approach as long as it is connected to landscape development. Credit any other valid approach. Evaluation should be based upon preceding content.	20 AO1=10 AO2=10
----	---	---	--

Marking grid for Question 03.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places. • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

	• Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Question 4 Glacial systems and landscapes

Qu	Part	Marking guidance	Total marks
04	1	Outline processes which lead to the development of a corrie. <u>Point marked</u> Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: <u>Point marked</u> AO1 • Snow is compacted to neve and then ice on a slope and gradually forms a nivation hollow (1). These are more likely to occur on north and / or north-eastern facing slopes where insolation rates are lower in the northern hemisphere (1) (d). • Over time and under the force of gravity the ice gradually moves down the slope (1). • Erosion through plucking and abrasion continues to carve out the hollow (1). • The ice moves under the force of gravity creating an armchair shape to the hollow (1). The process is referred as rotational slip (1) (d) • The back wall is then steepened by plucking and is exposed to weathering (once ice has melted), mainly freeze thaw frost shattering (1). This adds scree to various layers within and on top of the ice which itself can become a tool of abrasion (1) (d). Max 3 if only one process is considered. The notes for answers are not exhaustive. Credit any valid points.	4 AO1=4
04	2	Analyse the data shown in Figure 7a and Figure 7b. AO3 – Responses should accurately analyse the two data sets and see the connections between both. Identification of anomalies is also valid. <u>Mark scheme</u> Level 2 (4–6 marks) AO3 – Clear analysis and interpretation of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. Level 1 (1–3 marks) AO3 – Basic analysis and interpretation of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence.	6 AO3=6

		<u>Notes for answers</u> AO3 Figure 7a – All glaciers have seen a cumulative length reduction over the time period. Nigardsbreen has lost around 1300 metres in length more than the others over the observed period. Both Nigardsbreen and Brikdalsbreen saw temporary increases in length, starting in around 1992 and 8–10 years before the reduction continued. Three of the five glaciers have reduced their length by more or less the same amount (1250 metres). Storglacieren has seen the smallest reduction at around 600 metres. Figure 7b – is somewhat at odds with Figure 7a. Nigardsbreen for example has seen a net increase of 5 m w.e., yet Figure 7a suggests an overall reduction in length even over the period in question from 1960 onwards. The range of change is around 28 m w.e. across the 4 glaciers, with 3 of the 4 all registering a reduction in mass balance. Other calculations may feature such as the average rate of change in mass balance (approximately –10 m w.e.). Credit any other valid analysis.	
--	--	--	--

04	3	Using Figure 8 and your own knowledge, evaluate opportunities for developing a sustainable future for this region. AO1 – Knowledge and understanding of the management of cold environments at present and in alternative possible futures. AO2 – Applies knowledge and understanding in identifying possible opportunities for sustainable development of the Alps. <u>Mark scheme</u> Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to this novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.	6 AO1=2 AO2=4
----	---	--	---

		<u>Notes for answers</u> AO1 • Concept of environmental fragility. Human impacts on fragile cold environments over time and at a variety of scales. Recent and prospective impact of climate change. Management of cold environments at present and in alternative possible futures. • Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation. AO2 • Management of hazards associated with fluvioglacial activity will be a feature of the future sustainability of the Alps. Containing the meltwater and possibly even making use of green energy is one possibility. Reference to hydro-electricity may feature. • The traditional activities of tourism, farming, forestry and fishing are also under threat. In terms of forestry, there may be opportunities as the treeline rises further upslope. The climate will clearly be warmer and some species may be able to cope at higher altitudes. On the lower slopes, pest management will be important, not just in controlling invasive species seeking to exploit the new niche, but also limiting the potential impact of pests upon trees and other plants. • Tourism is likely to need to change in future. There is likely to be a shift away from winter skiing (or at least a move upslope for existing resorts) as the use of artificial snow is expensive and intrinsically not environmentally friendly. Summer tourism is a real opportunity in terms of stays at cabin lodges, hiking and adventure tourism. The animals moving to higher levels might provide opportunities for nature lovers to visit. Early blooming flowers might also prolong the tourist season for those with specific interests. Credit any other valid assessment.	
--	--	--	--

04	4	With reference to one or more cold environments that you have studied, assess the potential impact of climate change on the development of landforms. AO1 – Knowledge and understanding of the factors affecting landscape development in cold environments. AO2 – Applies knowledge and understanding to show how climate change might shape the physical features of cold environments. <u>Notes for answers</u> AO1 • Origin and development of glaciated landscapes. • Erosional and depositional landforms: corries, arêtes, glacial troughs, hanging valleys, truncated spurs, roches moutonnées. Characteristic glaciated landscapes. • Origin and development of landforms and landscapes of glacial deposition: drumlins, erratics, moraines, till plains. Characteristic glaciated landscapes. • Fluvioglacial landforms of erosion and deposition: meltwater channels, kames, eskers, outwash plains. Characteristic fluvioglacial landscapes. • Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluction, lobes, terracettes, thermokarst. Characteristic periglacial landscapes. • Physical characteristics of cold environments. Climate, soils and vegetation (and their interaction). • Recent and prospective impact of climate change. AO2 • Responses should consider the expected impacts of climate change on the physical landscape of their chosen cold environment. • Those who consider glaciated landscapes should note that a warming of alpine areas will lead to increased ablation, more erosion from warm based glaciers and increased erosion and weathering. This may be linked further to the development of features such as corries, aretes and truncated and u-shaped valleys. Clearly these features take a long time to develop but there is evidence that a warm climate will further develop these features. • Fluvioglacial erosion and deposition is also set to increase. As glaciers increase their rates of erosion, material is then provided for the fluvial processes to take over beyond the snout and under the glacier itself. Expect to see reference to kames eskers and braided meltwater channels. Clearly more water sediment will be provided and some may link this to disruptions to the outwash plain and increased propensity of flooding downstream. • In periglacial regions the main focus is likely to be the melting of permafrost and its impact on the landscape. Solifluction is likely to feature here as well as an increased emergence of thermokarst lakes.	20 AO1=10 AO2=10
----	---	---	--

		There should be some explicit assessment in the context of the question. This will depend upon the focus of the supporting cold environment. Credit any other valid assessment.	
--	--	---	--

Marking grid for Question 4.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts and processes throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts and processes (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts and processes (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).

Level 0 (0 marks)	• Nothing worthy of credit.
------------------------------	---

Section C

Question 5 Hazards

Qu	Part	Marking guidance	Total marks
05	1	Outline processes involved in the formation of ocean ridges. <u>Point marked</u> Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: <u>Point marked</u> AO1 • Convection currents operating in the mantle act like a conveyor belt driving movement of the lithosphere above (1). Where the currents move in opposite directions the crust is pulled apart allowing magma to extrude (1). Repeated action over thousands of years develops long ridges under water (1), for example the Mid Atlantic Ridge (1) (d). Where the ridge breaks through the surface of the water new land can be formed (1). • Ridge push occurs where the lava extrudes and cools (1). The more dense material is pushed under the force of gravity away from the top of the ridge (1). This also links to slab pull theory in that the more dense oceanic plate is pulled down into the mantle (1). The notes for answers are not exhaustive. Credit any valid points.	4 AO1=4

05	2	Interpret the data shown in Figure 9. AO3 – There should be interpretation of the information provided. <u>Mark scheme</u> Level 2 (4–6 marks) AO3 – Clear analysis and interpretation of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. Level 1 (1–3 marks) AO3 – Basic analysis and interpretation of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence. <u>Notes for answers</u> AO3 • There are some clear patterns within the data set. In the Atlantic, storms appear to be more frequent (around 6–12% increase). However just off the west coast of North America the opposite pattern is true with anywhere up to a 12% reduction in storms over the period in question. The contrast is very sharp and occurs over the west coast of Mexico (100°W and 10°N). • The area north of Australia through to the west Pacific region has also experienced a significant reduction in the frequency of storms, up to 15%. • The picture in the Indian Ocean is much more mixed with a quite clear split either side of the equator. North of the equator in this area storms are increasing by up to 6% whereas south of the equator around 80° E and 15° S there is a decrease of up to 9%, a difference of 15% in a relatively similar geographical area. • There are also some anomalies. Around Japan and the east coast of China there is an increase in storms (around 6%) compared to a very sharp decrease over the Philippines (–15%), a difference of around 21% over a relatively short distance. • Some may also notice that there is relatively more change occurring in the northern hemisphere compared to the southern hemisphere. Credit any other valid analysis.	6 AO3=6
----	---	--	-----------------------------------

05	3	Using Figure 10 and your own knowledge, assess challenges in responding to this event. AO1 – Knowledge and understanding of the management of seismic hazards. AO2 – Application of knowledge and understanding to the novel situation, to assess the impacts of the data for the management of seismicity in this region. <u>Mark scheme</u> Level 3 (7–9 marks) AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Discussion is detailed and well supported with appropriate evidence. Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Discussion is evident and supported with clear and appropriate evidence. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Discussion is basic and supported with limited appropriate evidence.	9 AO1=4 AO2=5
----	---	--	---

	<u>Notes for answers</u> AO1 • The nature of seismicity and its relation to plate tectonics: forms of seismic hazard: earthquakes, shockwaves, liquefaction, landslides. Spatial distribution, randomness, magnitude, frequency, regularity, predictability of hazard events. • Impacts: primary/secondary; environmental, social, economic, political. Short and long-term responses; risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation. AO2 • Data suggests that the entire archipelago has been affected by the tsunami following the Hunga Tonga Ha'apai eruption. • Remoteness was one major issue. The islands lie in the Pacific Ocean and so providing aid will have been a major challenge, not least in the timescales in which people are likely to have required it. • The island also had cases of transmittable disease, and this will have also been an issue hampering efforts to assist. • Communication out from the islands may have been difficult as evidenced by the damaged communication system. • Whilst only 4 people were recorded to have died, over 50 000 were in need of humanitarian assistance. This, combined with the lack of access, will have created a critical life-threatening situation. The health centre was destroyed, and it is not clear whether there were other facilities in order to provide emergency treatment. • Longer term, desalinating the coastal land which has been inundated will present a major challenge as will supporting the farming families. • The eruption may have also caused issues, such as the ash cloud normally associated with violent eruptions. This may have hampered air-based support and assistance. Credit any other valid assessment.	
--	---	--

05	4	To what extent do you agree that changes to the carbon cycle are responsible for increasingly frequent and severe tropical storms? AO1 – Knowledge and understanding of the water cycle. Knowledge and understanding of the factors affecting tropical storms. AO2 – Application of knowledge and understanding to assess the most likely reasons for increasingly frequent and severe tropical storms. <u>Mark scheme</u> Level 3 (7–9 marks) AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence. Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence. <u>Notes for answers</u> AO1 • The nature of tropical storms and their underlying causes. Forms of storm hazard: high winds, storm surges, coastal flooding, river flooding and landslides. Spatial distribution, magnitude, frequency, regularity, predictability of hazard events. • Changes in the water cycle over time to include natural variation including storm events. • The key role of the carbon and water stores and cycles in supporting life on Earth with particular reference to climate. The relationship between the water cycle and carbon cycle in the atmosphere.	9 AO1=4 AO2=5
----	---	---	---

		AO2 • Some may challenge the assertion of the question. The evidence is mixed as to whether storms are becoming more frequent and intense. For example, some responses may suggest that natural, cyclical variation is responsible for the spike in hurricanes since the 1980s. • However, as the planet warms and sea temperatures increase, theory would suggest that more sea areas will exceed to 27 °C ie the trigger for creating the conditions in which tropical storms emerge. Equally increasing sea temperatures should in theory increase rates of evaporation, providing more intensity to the storm. • To suggest that any increase in intensity and frequency is solely attributable to changes in the carbon cycle would be a narrow view though. Clearly it is the increase in atmospheric carbon which is responsible for the warming effect upon the atmosphere. However, without the combined impact upon the water cycle of increased evaporation and atmospheric moisture, there would be no storm. • It reasonable to argue that changes in the carbon cycle are the potential catalyst for increasingly severe and intense tropical storms, but there are more factors at play, not least in the water cycle. Credit any valid assessment.	
--	--	--	--

05	5	‘The Hazard Management Cycle is useful in minimising the impact of wildfires.’ Evaluate this view with reference to a wildfire event that you have studied. AO1 – Knowledge and understanding of the Hazard Management Cycle. AO2 – Application of knowledge and understanding to assess the importance of physical and human factors affecting the hazard. <u>Notes for answers</u> AO1 • Nature of wildfires. Conditions favouring intense wild fires: vegetation type, fuel characteristics, climate and recent weather and fire behaviour. Causes of fires: natural and human agents. • Impacts: primary/secondary, environmental, social, economic, political. Short and long-term responses; risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation. • Impact and human responses as evidenced by a recent wild fire event. • Characteristic human responses – fatalism, prediction, adjustment/adaptation, mitigation, management, risk sharing – and their relationship to hazard incidence, intensity, magnitude, distribution and level of development. The Park model of human response to hazards. • The Hazard Management Cycle. AO2 • Expect definitions of the Hazard Management Cycle (HMC) and possibly comparisons with other models such as the Park model. • The Hazard Management Cycle considers the management of a hazard from pre-event (mitigation and preparedness) to post event (response and recovery). • In terms of an approach to minimising the impact of wildfires in fire-prone areas, the HMC works well. • Mitigation involves the use of satellite sensors, cameras and observation from high platforms. It can also include regular visits and bush clearing in fire-prone areas; controlled burning may also feature. Building regulations can be tightened to ensure that homes are built with fire-retardant materials. Fire brigades can also create fire breaks or use fire-retardant materials on targeted vegetation. • Preparedness involves action taken at local level to implement plans in the event of a wildfire. Recognising warnings and alerts, emergency planning, strengthening the home, knowing evacuation routes, and having emergency supplies are some of the main ways that individual families and communities can prepare for an event in a fire-prone area. • Response takes place during the event and involves tackling the blaze using water sources, fire engines and planes (depending upon the level of development). Evacuation is also likely to feature.	20 AO1=10 AO2=10
----	---	---	--

		• Recovery includes rebuilding communities with support from insurance companies and government agencies. Education initiatives may feature as part of both recovery and mitigation. • Some may compare different models. This is a legitimate approach as long as there is some coverage of the HMC and that the focus of the response is on minimising the impact of the hazard. • Cases studies are likely to include the Black Saturday bush fires in Australia in 2009 or the Alberta Wildfire in 2016. Any relevant case is acceptable. • There should be some assessment of the usefulness of the model and this should include its limitations. For example, the model is only realistically effective in wildfire-prone areas. Places not used to wildfires, which experience unusual dry spells are almost certain to be ill-equipped. Similarly places where wildfires are started by human activity outside of fire-prone areas are almost certain to be caught off guard. Climate change is only set to exacerbate the issue as more areas experience extreme weather events, particularly in regard to hot spells. Credit any other valid assessment.	
--	--	---	--

Marking grid for Question 5.5

Level/ Mark Range	Criteria/Destructor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts and processes (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts and processes (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Question 6 Ecosystems under stress

Qu	Part	Marking guidance	Total marks
06	1	Outline processes involved in mineral nutrient cycling in an ecosystem. <u>Point marked</u> Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: <u>Point marked</u> AO1 • This is the circulation of nutrients through the biotic and abiotic components in an ecosystem (1). Weathered rock provides the main input of nutrients (such as nitrogen, phosphorous and potassium) into the system (1). Biotic to biotic transfer also occurs through the decomposition process (1). Pioneer species take up nutrients such as potassium and nitrogen (1). When these plants die, decomposition releases the nutrients and a basic soil structure emerges (1). When more complex plant life colonises, the decay and leaf litter provides input into a continuous cycle between soil, biomass and litter (1). The notes for answers are not exhaustive. Credit any valid points.	4 AO1=4

06	2	Analyse the information shown in Figure 11. AO3 – Analysis relates to identification of pattern and trends as well as anomaly. There is also opportunity to manipulate data. <u>Mark scheme</u> Level 2 (4–6 marks) AO3 – Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. Level 1 (1–3 marks) AO3 – Basic analysis of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence. <u>Notes for answers:</u> AO3 • All species have some level of endangerment with Cycads being the only species with some level of extinction in the wild. Cycads also have the highest level of critically endangered species, endangered and vulnerable. When the three categories are combined this is around 30% more than the next highest (conifers). Equally they comprise the smallest group (307) of species of all groups, 10 659 less than the bird species for example. • It is not clear why there is such a large range in the data deficient category. 40% of sharks and rays are data deficient whereas only 1–2% of Cycads are data deficient. This level of data deficiency raises questions about the reliability of the data ie actual levels of shark and ray vulnerability could be much higher, rendering the estimates to be unreliable. • Coral is unusual in that virtually none is critically endangered but around 25% is vulnerable, the largest of all species. Coral also forms the largest group of near threatened. • Calculations of actual number of species threatened are also possible eg around 22% of 10 966 bird species are threatened – 2412 bird species. Credit any other valid analysis.	6 AO3=6
----	---	--	-----------------------------------

06	3	Using Figure 12 and your own knowledge, assess the potential impact of human activity on this food web. AO1 – Knowledge and understanding of food webs and food chains. AO2 – Application of knowledge and understanding to assess the impact of human activity on this food web. <u>Mark scheme</u> Level 3 (7–9 marks) AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis is detailed and well supported with appropriate evidence. Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis is evident and supported with clear and appropriate evidence. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis is basic and supported with limited appropriate evidence.	9 AO1=4 AO2=5
----	---	---	---

	<u>Notes for answers</u> AO1 • Nature of ecosystems – their structure, energy flows, trophic levels, food chains and food webs. • Factors influencing the changing of ecosystems, including human exploitation. AO2 • The most serious impact is probably that undertaken by the clam harvester. The clams are at trophic level 2 and provide a food source for sea bream. • The unintended impact of the clam harvesting is more serious and wide ranging. The harvester clearly collects other species such as the filter feeders, detritivorous macrobenthos and omnivorous macrobenthos. This has ramifications across the whole food web with the exception of the seabass and mullets. This will limit the food sources for Benthic predators and Gobies as well limiting the fisheries and food source for the fish-eating birds. • Also by churning up the bottom sediment this also potentially impacts further up the food chain. • Essentially the clam harvesting is potentially damaging to the entire food web. • The fisheries themselves seem to have less impact on the whole web as they only take out the trophic level 3 and 4 species. However, with no predators, the trophic 3 species will most likely proliferate and may cause overconsumption of the producers eg, epiphytes and seagrass. This could destabilise the overall ecosystem. • Another reasonable interpretation of the data is potential impact of pollution caused by the fisheries and clam harvesting. Noise, oil from fuel and air pollution could all affect the ecosystem negatively. Credit any other valid assessment.	
--	--	--

06	4	How far do you agree that changes to the carbon cycle are leading to an increasingly uncertain future for coral reefs? AO1 – Knowledge and understanding of the carbon cycle. Knowledge and understanding of factors affecting coral reefs. AO2 – Application of knowledge and understanding to assess the future prospects of coral reefs. <u>Mark scheme</u> Level 3 (7–9 marks) AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence. Level 2 (4–6 marks) AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence. Level 1 (1–3 marks) AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence. <u>Notes for answers</u> AO1 • Factors in the health and survival of reefs: Natural: Water temperature, acidity, salinity, algal blooms. Human activity and its impact: Major drainage basin schemes, onshore development, desalination, pollution, tourism, fishing. • Future prospects for coral reefs. • The key role of the carbon and water stores and cycles in supporting life on Earth with particular reference to climate. The relationship between the water cycle and carbon cycle in the atmosphere. • Changes in the water cycle over time to include natural variation including storm events, seasonal changes and human impact.	9 AO1=4 AO2=5
----	---	--	---

		AO2 • Coral is under threat from sea temperature changes, increased carbon concentrations in the sea water (causing acidification) and the increasing frequency and intensity of tropical storms. • Direct human activity is also a major threat facing coral eg pollution, development and fishing activity. • Both sea temperature changes and the acidification of sea water can be directly attributed to climate change. This itself can then be attributed to changes in the carbon cycle. Those who argue in this way certainly have validity. • Equally the increasingly intense and frequent tropical storms facing such locations could also be attributed to changes in the carbon cycle. Here the science is less certain, but responses could legitimately argue that this is the case. • Those who argue that human activity is the greatest threat to coral are free to do so provided that some consideration is given to changes in the carbon cycle. • Most are likely to argue that the future of coral is highly uncertain though this is likely to depend on the chosen support should this be offered. Credit any other valid approach. Evaluation should be based upon preceding content.	
--	--	--	--

06	5	With reference to one plagioclimax in the British Isles, assess the factors affecting change and development in this ecosystem. AO1 – Knowledge and understanding of the factors of changing ecosystems and the concept of plagioclimax. AO2 – Application of knowledge and understanding to assess the factors affecting change and development in the chosen plagioclimax. <u>Notes for answers</u> AO1 • Nature of terrestrial ecosystems and the inter-connections between climate, vegetation, soil and topography which produce them. Ecosystem responses to changes in one or more of their components or environmental controls. • Factors influencing the changing of ecosystems, including climate change and human exploitation of the global environment. Concepts of succession: seral stages, climatic climax, sub-climax and plagioclimax. • The effects of human activity on succession – illustrated by one plagioclimax such as a heather moorland. • The impacts of change and measures to manage these impacts. Conservation strategies and their implementation in specific settings. ○ Case study of a specified ecosystem at a local scale to illustrate and analyse key themes set out above, including the nature and properties of the ecosystem, human impact upon it and the challenges and opportunities presented in its sustainable development. AO2 • Most are likely to consider heather moorland though any plagioclimax could be considered. • Heather moorland is found across much of upland Britain. It is a good example of heavily managed plagioclimax. • The climatic climax vegetation is normally deciduous woodland. The first change was caused by ancient settlers who removed the trees for the purposes of creating farmland. The unintended impact of this was that exposed soils were quickly eroded. These were then colonised by more hardy species able to cope with the acidic and infertile peat-based soils. In this sense the change was not just to the vegetation but also the soil structure. • More recent development has come in the form of upland hill sheep farming and grouse shooting. • The areas have been heavily managed in recent years often with controlled burning in several areas. This ensures that no succession can occur and that the heather remains as the dominant plagioclimax species. The burning also destroys the less palatable and less nutritious woody parts of the plant. The younger shoots are ideal for both wildfowl and sheep grazing. • Burning has come into focus not least because of its impact on biodiversity and climate change. Moorland wildfire, (such as	20 AO1=10 AO2=10
----	---	---	--

		Saddleworth in 2018) and a general concern about the environmental damage associated with controlled burning, has led many landowners to ban this management technique. Burning not only potentially affects biodiversity but it also risks accidentally igniting the peat. This raises questions about the future of grouse shooting on moorland. • The future may well involve other activities and uses to ensure the sustainable economic and environmental future of moorland. Adventure sports and other outdoor activity might provide part of the answer. Credit any other valid approach.	
--	--	--	--

Marking grid for Question 6.5

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	- Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). - Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). - Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). - Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). - Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	- Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question (AO2). - Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). - Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). - Generally clear and accurate knowledge and understanding of key concepts and processes (AO1). - Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	- Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). - Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). - Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). - Some knowledge and understanding of key concepts, processes and interactions and change (AO1). - Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	- Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). - Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). - Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). - Very limited relevant knowledge and understanding of place(s) and environments (AO1). - Isolated knowledge and understanding of key concepts and processes (AO1).

	• Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.