Cambridge International Examinations
Cambridge Pre-U Certificate

GEOGRAPHY (PRINCIPAL) **9768/01**

Paper 1 Global Environments **For Examination from 2016**

SPECIMEN MARK SCHEME

1 hour 30 minutes

MAXIMUM MARK: 50

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document consists of **20** printed pages.

Guidance notes for marking 9768/01

Levels of response marking is used for the 6 mark and the 15 mark questions.

This Mark Scheme contains, on the following page, the **Generic Mark Scheme** (GMS) used for assessing all pieces of extended writing bearing 15 marks in the Cambridge Pre-U Geography, followed by **Indicative Content** for each question.

Whilst the GMS captures the essential generic qualities of responses in 5 mark bands (Levels), the Indicative Content is what it says: some indication of the probable content or possible approaches to, the questions and titles set. Candidates may develop their own approaches to questions. Examiners should not expect to find all the Indicative Content in any one response. Responses may be placed in any GMS Level without fulfilling all the descriptors for that mark band. Responses may exhibit characteristics of more than one Level and so examiners use the principle of best fit in determining response quality.

Cambridge expects Examiners to use their geographical judgement and professional experience, combined with guidance given by Senior Examiners at the Standardisation Meeting and during the standardisation process, in assessing responses appropriately.

Generic Mark Scheme (GMS)

Level	Marks	Assessment criteria
5	**13–15**	• Detailed and accurate knowledge and clear, high order understanding of the subject content • Relevant and accurate exemplification used effectively • Clear organisation; good English expression; accurate use of geographical terminology • Fully focused on the specific demands of the question • Thorough analysis and a critical approach to evaluation; appropriate application of concepts and theories • Conclusion is logical and well founded on evidence and argument
4	**10–12**	• Good knowledge and depth of understanding of the subject content • Appropriate and effective exemplification • Logical organisation; sound English expression; appropriate use of geographical terminology • Well focused on the demands of the question • Good analysis and evaluation; generally appropriate application of concepts and theories • Conclusion is sound and based on evidence and argument
3	**7–9**	• Sound knowledge and understanding of the subject content lacking depth in some areas • Appropriate but partial exemplification, may not be integrated with the argument • Generally clear communication but lacking some organisation; English expression and use of geographical terminology are mostly accurate • Specific demands of the question mostly met • Some ability to analyse and evaluate; limited application of concepts and theories • Conclusion is limited and has some links to the rest of the response
2	**4–6**	• Some knowledge and understanding of the subject content lacking depth and detail • Exemplification used may be limited • Limited organisation; English expression is basic with some accurate use of geographical terminology • Question is addressed broadly or partially • Analysis, evaluation and application of concepts and theories are limited and may be superficial • Conclusion is basic and may not be linked to the rest of the response
1	**1–3**	• Little knowledge and understanding of the subject content • Exemplification, if used, is simple or may not be relevant • Lack of clarity and organisation; English expression is simple with inaccuracies; geographical terminology is basic or not understood • Question is understood weakly and may be addressed slightly • Superficial statements replace analysis and evaluation; application of concepts and theories may be minimal or absent • Conclusion may be absent or simply asserted
0	**0**	• No creditable response.

Section A

Hot Arid and Semi-Arid Environments

1 (a) Fig. 1A shows changes to the surface area of water in the Aral Sea basin, 1960 to 2009 and Fig. 1B provides information about the surrounding area in Central Asia.

(i) Using Fig. 1A, briefly describe the changes in surface area of water in the Aral Sea basin since 1960. [4]

The sea area has become smaller/reduced in size (1)
Changed shape, split, (2) for the fourth mark some indication of amount of shrinkage (1) is the discriminator.

(ii) Using Fig. 1B, examine the possible impacts of human activity for the Aral Sea and the surrounding area. [6]

Human activities are: irrigation – water extraction from the sea. Ground water supplies lower the water table, mention of aquifers, possible compromise of water quality as well as supply. Less water flowing into the Aral Sea therefore shrinkage. Evaporation of surface water leads to salinisation of soils, canal building – may compromise surface water flows/ run-off/discharge.

Urbanisation – increased impermeability of surfaces – increased run-off, discharge potential for flash flooding although possibly unlikely given the aridity of the area.

Higher temperatures because of urban heat islands could be mentioned as a valid idea.

Understanding of processes and impacts rather than the number of human activities covered is important in responses.

Candidates show:

L3: clear and detailed understanding of the issues. Analysis is to the fore and the points made are well supported with relevant evidence. **[5–6]**

L2: a limited range of valid points with some analysis. Provides support for some observations / somewhat lacking in evidence. **[3–4]**

L1: little knowledge and understanding of the topic. Little or no attempt at analysis; the approach may be largely descriptive with limited reference to evidence. **[1–2]**

L0: no creditable response. **[0]**

EITHER

(b) (i) To what extent is wind a major factor in the processes of transportation and deposition in hot arid environments? [15]

Indicative content
Wind as an agent of transportation: processes of traction, saltation, and suspension. Wind as an agent of deposition and how it operates. Reduction in velocity.

Wind contributes to the formation of a range of landforms: dunes of all types.

However, wind is not the only agent, and candidates will need to consider water as an agent of transportation and deposition. Many responses may focus on wadis as the basis of the argument, although the syllabus itemises alluvial fans and bahadas and chotts as the quintessential water transported and deposited landforms.

Candidates may take a historical perspective and consider the pluvials of the Quaternary. Then consider the erosional landforms which are found in the desert to reach an evaluative conclusion about the fact that water tends to erode whereas wind deposits. Both agents transport and some detailed comparison as well as contrast will form the basis of the best answers.

Higher level answers will be focused on wind and then argue about the role of water, making reference to both processes and the resultant landforms, which may be illustrated by well labelled diagrams integrated into the text. There will be a conclusion which may extend the argument suggesting that the past is different from the present in terms of the dominant agent at work in the hot arid landscape.

Lower level answers may be characterised by limited references to landforms which are the result of the processes of transportation and deposition. Dunes will probably dominate the answer. These responses may lack three essential elements: a structured argument, a final convincing evaluation (possibly some of these answers will fail to discuss water at all) and diagrams that demonstrate a realistic illustration of the landform discussed.

OR

(ii) 'Traditional lifestyles found in hot arid and semi-arid environments interact sustainably with the physical environment.' Discuss the validity of this statement. [15]

Indicative content
Traditional lifestyles: nomadic and semi-nomadic.

There may an argument for small scale subsistence sedentary agriculture like the 'gardens' of the East African Rift valley. Accept the examples chosen provided they display the expected characteristics. There will need to be knowledge of the system of agriculture, the use of available resources e.g. land and water supply, use of resources for firewood and building as well as a food supply. Examples to illustrate the underpinning principles. Then how and why the systems are sustainable and both short and long term considerations. The answers may be underpinned by theories and concepts like recovery periods. Evaluation of the question will be couched in terms of scale, population levels and physical factors like natural hazards and extreme weather events, e.g. heatwaves leading to droughts. Specific named examples will enhance the answers.

Higher level answers will contain detailed knowledge of nomadic and semi-nomadic ways of life with the use of specific named located examples. There will be an underpinning understanding of the concept of sustainability, the use of resources, and some acknowledgement of the role of the physical environment and processes in limiting the lifestyles of people living there.

Lower level answers may be characterised by a tendency to be knowledge based and may not engage in a discussion of how the lifestyles and activities of people living there interact with the physical environment. The concept of sustainability may not be convincing and the conclusions weaker in terms of evaluation. Examples may be somewhat sketchy in terms of detail of location and way of life.

Glacial and Periglacial Environments

2 (a) Photograph A shows part of the glaciated upland area of Snowdonia, North Wales.

(i) Identify the landforms labelled X and Y on the photograph and for <u>one</u> of these landforms describe its principal characteristics. [4]

X is a corrie/cirque or tarn/corrie/cirque (1): bowl-like feature at the head of a glacial valley, with steep sides at the back and a scooped out appearance (1).

Y is an arête (1): a thin knife-like ridge of rock between two U-shaped valleys (1).

(ii) Using Photograph A, identify and explain the evidence shown for glaciation in this area. [6]

Evidence: location, shape and scale. Shape of the cirque, depth, scale. Position backed by watersheds which are now arêtes. Long, knife/precipitous edges of the arêtes, recession of adjacent cirques backwalls, some evidence of plucking from the craggy appearance of rock faces and uneven slopes. The evidence needs to include reference to the photograph, to process and to specific elements of the landforms. Some candidates may point out the glacial trough downstream of the cirque and its shape and form to denote glacier movement and erosion.

Candidates show:

L3: clear and detailed understanding of the issues. Analysis is to the fore and the points made are well supported with relevant evidence. **[5–6]**

L2: a limited range of valid points with some analysis. Provides support for some observations / somewhat lacking in evidence. **[3–4]**

L1: little knowledge and understanding of the topic. Little or no attempt at analysis; the approach may be largely descriptive with limited reference to evidence. **[1–2]**

L0: no creditable response. **[0]**

EITHER

(b) (i) Examine the relative importance of the processes which result in glacier movement. [15]

Indicative content

There are several different processes which vary according to the local conditions, i.e. warm based vs cold based glaciers (temperate vs polar glaciers).

Basal sliding; internal deformation; inter-granular sliding; compressional and extensional flows, sub-glacial deformation.

Warm based glaciers, 50 % of movement by basal sliding, a water film at glacier base and then refreezing around irregularities. This is the result of differential pressure. Sliding occurs because pressure melting point is lower than the normal 0 °C so a thin film of water forms beneath the ice.

Deformation within is the result of plasticity under its own weight. Compressional and extensional flow results from the inability of the ice to adjust quickly enough to stress so tensional fractures (crevasses) are created. Usually created by changes in the bedrock topography beneath the ice.

Intergranular deformation/sliding is when there is slippage between individual grains of ice within the glacier.

Higher level answers will have a sound detailed knowledge of the different processes, indicate an understanding of how they operate within this physical system and be able to reach a conclusion about the relative importance of the processes under different conditions.

Lower level answers may be characterised by a lack of comprehensive knowledge of the processes and may not be able to make an assessment if the answers are on shaky ground with respect to glacier type.

OR

(ii) Assess the extent to which human activity in the periglacial environment has had long term impacts? [15]

Indicative content

Some indication of the location and characteristics of the periglacial environment is needed. This may include more detail than just the presence of ice in the landscape but good candidates may extend the argument to ecosystems too. Both human and physical activities can be the cause of long term impacts. Candidates may refer to construction, exploration of resources, urbanisation and tourism as well as traditional ways of life and the potential impacts of human-induced climate change. Mention should be made of the state of the ground because the annual thawing of the active layer creates potential problems which can be exacerbated by human activities, e.g. the activities create stresses which lead to subsidence, causing foundations to falter, building stress/collapse, pipelines to crack and leaks to occur. Any changes to the fragile ecosystems are long term as the recovery period is long. Evaluation will require consideration of short term impacts too and possibly an assessment of the relative scale and severity of these impacts.

Higher level answers may demonstrate knowledge beyond the ice covered landscape and have a keen awareness of long vs short term impacts which will be addressed both throughout the essay and in the conclusion. There will be strong knowledge of the physical processes operating within a periglacial environment. Diagrams are appropriate and in the best responses these will both illustrate and enhance the argument.

Lower level answers may concentrate upon the human activities without consideration of their impact on the physical environment. There may be little awareness of the difference between long and shorter term impacts. Evaluation may only occur in the conclusion or be superficial in nature.

Coastal Environments

3 (a) Fig. 2 is an Ordinance Survey map extract showing an area of the Essex coastline, East Anglia, UK.

(i) Using evidence from Fig. 2, identify the landform labelled C and the process responsible for its formation. [4]

A spit (1); longshore drift (1).

Evidence (2):

Groynes; a narrow beach of sand which protrudes further along the coast into the inlet and ends in open water.

The other end is joined to the main part of the coastline.

There is indirect evidence like the mud flats but a description of the spit is the best line of evidence.

(ii) Explain the development of the salt marsh shown at D. [6]

Salt marsh succession behind the spit. Deposition within the estuary sediment transported by rivers from the land and deposited in the shallow sheltered water behind the spit. The reason is the meeting of salt and fresh water which creates flocculation of the particles and then their size means that the water can no longer transport them, which leads to deposition. As the mud accumulates a limited number of salt water tolerant varieties of plants will colonise. Gradually as the mud builds up there is more exposure to air in the intertidal zone and a greater diversity, number and height of plants colonise. They in their turn start to anchor the mud so a cycle of deposition and colonisation occurs to form this halosere. Species should be named and the concept of succession, diversity, height adaptations and competition should be evident. Diagrams could be useful to illustrate the succession and enhance the discussion of the processes. The best answers will acknowledge the map area in their responses and may be aware of flocculation as the keynote for deposition.

Candidates show:

L3: clear and detailed understanding of the issues. Analysis is to the fore and the points made are well supported with relevant evidence. **[5–6]**

L2: a limited range of valid points with some analysis. Provides support for some observations / somewhat lacking in evidence. **[3–4]**

L1: little knowledge and understanding of the topic. Little or no attempt at analysis; the approach may be largely descriptive with limited reference to evidence. **[1–2]**

L0: no creditable response. **[0]**

EITHER

(b) (i) 'Sea-level change produces distinctive landforms.' With reference to <u>three</u> landforms produced due to sea-level change, discuss the validity of this statement. [15]

Indicative content
There are a range of landforms in the syllabus which could be used including: submerged valleys, rias, estuaries and fiords. Also emerged highland coasts producing raised beaches and relict cliff lines, and emerged lowland coasts, barriers, beaches and islands. The focus will need to be on the idea of distinctive as the differentiator between the higher and lower level answers as both will be rooted in knowledge. Diagrams are appropriate to illustrate the answer.

Higher level answers may contain diagrams which are fully integrated into the text. Knowledge and examples of landforms may be detailed and there should be an awareness of the word distinctive throughout which is defined according to frequency and scale. It is likely that most answers will agree that the statement is valid. However, different opinions can be awarded higher level marks, provided there is justification for the point of view.

Lower level answers will be generally less knowledgeable in terms of range and detail of the landforms chosen. The argument may not be convincing and discussion of the distinctive qualities may be superficial.

OR

(ii) Evaluate the sustainability of managed realignment in coastal environments, with reference to specific examples. [15]

Indicative content
Managed realignment is another term for managed retreat, which involves allowing nature to take its course but with some intervention in the initial stages, e.g. the land may be breached to allow the sea to produce a salt marsh over time, which then acts as a natural buffer against high tides, storms and inundation due to rising sea levels.

A natural salt marsh is created which is economic to establish after any initial compensation has been paid. It is the preferred choice of coastal protection in areas like East Anglia which is low lying and had salt marshes before sea walls were built. They are sustainable because whilst they cannot be used for commercial purposes, the natural processes, if plant succession takes place and is left undisturbed, will provide a natural sponge for water which may encroach. Mangroves and sand dune protection may also be seen as examples of managed realignment. Ideally the idea of realignment and prograding coasts as the result of the management should be made clear.

Whilst the focus of the argument will be managed realignment there may be some evaluation of other methods like soft and hard engineering in relation to sustainability.

Higher level answers should be able to debate the pros and cons of the various strategies. Evaluation of costs and benefits may be largely in financial terms, although the top level answers should acknowledge the environmental as well as economic and social costs.

Lower level answers may largely depend on factual knowledge of the strategies and may be far stronger on hard and soft engineering and less 'au fait' with managed retreat/ realignment. Evaluation of the strategies may be limited to the conclusion. The concept of sustainability may not form the focus of the evaluation and might be superficial with little understanding of the concept evident.

Section B

Tropical Environments

4 (a) Figs 3A and 3B show rainfall and temperature characteristics of two tropical areas.

(i) With reference to Figs 3A and 3B, briefly describe the principal characteristics of rainfall and temperature [4]

Tropical Rain Forest/Equatorial Climate – high temperatures and rainfall all the year round. Savanna Climate: temperatures and seasonal rainfall mostly in the summer months (June to November). There must be some reference to temperature and rainfall and figures for full marks.

(ii) Explain how the Inter Tropical Convergence Zone (ITCZ) influences the patterns of rainfall and temperature shown in Figs 3A and 3B. [6]

ITCZ – over the equator all the year round. Low pressure because of converging, rising air cooling and condensation causing convectional rainfall. High temperatures due to the high angle of sun but also subdued due to cloud cover, so not the highs and relative lows of the savanna.

Migration of the sun to the tropic of Cancer in June bringing rain as on the equator, high seasonal angle of sun in June compared with the winter when the ITCZ has migrated to the southern tropic. There needs to be an account of both temperature and rainfall and the migration of the ITCZ, and of the idea of convectional rainfall, cloud cover and the sun's angle in the sky.

Candidates show:

L3: clear and detailed understanding of the issues. Analysis is to the fore and the points made are well supported with relevant evidence. **[5–6]**

L2: a limited range of valid points with some analysis. Provides support for some observations / somewhat lacking in evidence. **[3–4]**

L1: little knowledge and understanding of the topic. Little or no attempt at analysis; the approach may be largely descriptive with limited reference to evidence. **[1–2]**

L0: no creditable response. **[0]**

EITHER

(b) (i) Assess the role of water movement in the formation of tropical soils. [15]

Indicative content

Underpinning this question is an acknowledgment that water is related to climate, which is one of the factors influencing soil formation. The others are geology, vegetation, human activities, relief and time. The interplay of these factors produces the soil forming processes such as ferralitisation which are key to the formation and development of tropical soils. A good answer will contain a soil horizon diagram and the answer will focus on ferallic soils or latosols. The nomenclature may vary according to teaching. Candidates will know that the climate produces a ratio of p>E so that there is vertical downward movement of water causing minerals to be removed in solution. In the tropics silica is unstable and the sesquioxides of iron and aluminium remain stable, retaining the characteristic red colour of the soils. They are deep because these processes are active perennially and the soils have been undisturbed for millennia. Horizonation is distinctive also because of active ferralitisation. Consequently, candidates will conclude that water movement is a major, if not the overriding factor because it produces a p>E ratio which allows the stability of sesquioxides, but that time is also important in producing their depth. Vegetation plays a role in acidification, encouraging the processes, but the other factors are secondary. Good candidates may focus on a few factors rather than trying to cover the role of every factor.

Higher level answers will appreciate the role of water that is related crucially to the climatic factor and that other factors play a secondary role. These answers will have a well labelled soil profile diagram at the heart of the response in order to illustrate the points made.

Lower level answers will be less secure in their appreciation of the distinction between factors and processes, and their overall knowledge of the components and functioning of the soil system will not be so detailed. There may be a soil horizon diagram but it may not be especially well developed and/or accurate. The role of time may or may not be acknowledged. The evaluative aspect in terms of the roles of other factors will not be at the heart of any conclusion made.

OR

(ii) Assess the extent to which tribal communities can be considered to make sustainable use of the tropical rainforest? [15]

Tribal communities are the relatively small groups which inhabit areas like the Amazon Basin. Few now have escaped contact with the global environment but there are pockets of hunters and gatherers and shifting cultivators left. These traditional activities have for centuries provided forest resources for food supply and materials for hunting, building and fires etc.

The underpinning concepts are the semi-nomadism of the shifting cultivation system and the use and recovery cycles which lie at the heart of this system. Knowledge of the system and how it is related to forest regeneration, the time scales and why regeneration is relatively so fast, should be included. This will acknowledge some references to physical processes during the course of discussion.

Today the constraints on sustainability are outside influences, such as the desire for commercialisation, large scale deforestation, possible climate change but principally population increase. These traditional systems are able to operate sustainably provided the recovery period is long enough. Returning to a plot before the soil fertility is restored means a successive reduction in crop yields.

Higher level answers will have detailed knowledge of the shifting cultivation and the subsistence nature of the farming, that it operates provided the nutrient cycles are restored between clearance, the inherent infertile nature and relative fragility of tropical soils and the way in which the system can return some fertility via the initial burning of the vegetation. The constraints may be discussed without too much focus on global warming. Diagrams illustrating the cycles may accompany the answer but should be underpinned by an awareness of physical processes. The concept of sustainability should form an integral part of the argument.

Lower level answers will tend to describe the system of shifting cultivation but the application of the system to the concept of sustainability will be given less emphasis so that the question is not addressed and concluded sufficiently or adequately.

Temperate Environments

5 (a) Fig. 4 is an adapted extract from Chapter 1 of *The Grapes of Wrath*, written by John Steinbeck in 1939. Table 1 shows the frequency of dust storms in the American Mid-West for the period 1932 to 1941 to which Steinbeck was referring.

(i) Briefly outline the consequences of the weather conditions described in Fig. 4 and Table 1 for the population of Oklahoma during this period. [4]

Physical consequences: storms – high winds, drought-aridity, soil erosion, degradation, a layer of dust blanketing the landscape, land stripped of vegetation.

Human: loss of the maize/corn crop, no income poverty, psychological consequences, despair and depression.

The consequences may be local, affecting the population and the state, but also global because the American Mid-West is one of the 'bread baskets' of the world as suggested in the syllabus. This case study is mentioned specifically.

(ii) Explain how and why these conditions occurred. [6]

- Prolonged drought
- Frequent storms
- A flat landscape cleared of grassland for extensive arable farming.
- No wind breaks
- Ploughed land for large scale production of corn (a staple crop for bread making)
- Young corn is low growing
- A good deal of bare exposed soil between the rows of crops.

For 6 marks there needs to be an awareness of both physical and human factors and processes.

Candidates show:

L3: clear and detailed understanding of the issues. Analysis is to the fore and the points made are well supported with relevant evidence. **[5–6]**

L2: a limited range of valid points with some analysis. Provides support for some observations / somewhat lacking in evidence. **[3–4]**

L1: little knowledge and understanding of the topic. Little or no attempt at analysis; the approach may be largely descriptive with limited reference to evidence. **[1–2]**

L0: no creditable response. **[0]**

EITHER

(b) (i) To what extent do you consider low impact farming initiatives in temperate environments to be sustainable? [15]

Indicative content

The UK government has moved on from set-aside, which was abandoned in 2008, and in 2011 produced a report entitled *The future of food and farming*. More recently they have issued another report in support of developing high technology strategies for boosting the farming industry which does not appear to focus particularly on the smaller scale, lower impact nature of strategy decisions. However, within the EU there are several moves within the CAP to encourage organic farming, something which is happening in the UK too, and schemes such as Ecological Focus Areas (EFA's). These are areas in which the farmer is encouraged to leave the land to natural processes and create buffer zones and hedgerows at the field boundaries, to encourage pollinating insects and bird populations to thrive and reduce soil erosion and pollution. These policies are environmental policies rather than production driven policies. Credit knowledge of other low impact farming initiatives. An ability to apply that to the concept of sustainable farming with an appreciation of the necessity to provide high yields and a living income for farmers will underlie the best answers.

Higher level answers will be characterised by arguments about a range of strategies, their low impact and their relation to sustainability of land based resources such as water and soil. Good responses may well also focus on the idea of sustainable business models where extensive agriculture and high yields is now the default position if farmers are to make a living. Therefore large scale deforestation has been necessary and regeneration of the forests will never be more than a small scale niche activity.

Lower level answers may lack range and detail of knowledge of low impact schemes and the application of the idea of sustainability within the temperate forest environment may be superficial or lacking evaluation. Although there may be reference to large scale arable farming in areas like East Anglia, the argument may not relate fully to the question of whether the lower impact initiatives are superior and permit sustainability.

OR

(ii) Evaluate the relative importance of the factors and processes which influence the development of one zonal soil found in temperate environments. [15]

Indicative Content

The zonal soils listed in the syllabus are brown earth, podsol and chernozem. Any one of these may be selected for discussion. There needs to be development of the relative roles of factors (climate, vegetation, geology, relief, human activities) which in turn produce the soil forming processes (lessivage, leaching, podsolization, salinisations, capillary action). Soil horizon diagrams may form part of a successful answer.

Higher level answers include a well labelled integrated diagram, knowledge of both factors and how their interplay underpins the processes which in turn create the soil. The argument may well focus on the importance of the p:E ratio which produces either upward or downward water movement in the soil. There should be some assessment of the interplay and relative importance of these combinations.

Lower level answers may demonstrate knowledge of the soil selected and a basic knowledge of how they are formed. However, the awareness of the dynamics of their soil system and the assessment of relative importance of the climate factor as it influences the processes of water movement and leaching or capillary action will be less well documented. The conclusion may not relate well to the question.

The Atmospheric Environment

6 (a) Fig. 5 shows the global distribution of average annual solar radiation.

(i) Describe the pattern of average annual solar radiation shown in Fig. 5 [4]

Global pattern follows latitude in broad bands with the highest values being along the Equator. Highest values are 225 to 275 watts over Africa and the Middle East, i.e. land areas. The band is mostly continuous along the Tropic of Cancer. In the southern hemisphere at the same latitude the band is more broken by pockets of higher insolation. Lowest values are over the Arctic 75 to 100 watts. The best example of an anomaly is California (W USA) where 250 watts can be found. Statistics from the map and/or an anomaly are essential for 4 marks.

(ii) Explain the pattern of average annual solar radiation shown in Fig. 5. [6]

Reasons: Distribution of land and sea and the consequent specific heat capacities of land and water. Overhead sun and cloud over Equatorial regions whereas over the tropics sub-tropical high pressure belt produces no cloud and overhead sun. This produces high temperatures due to intense radiation of the earth's surface. In high latitudes the sun's angle is low and the distance travelled through the atmosphere is greater so more heat is lost on route via absorption, scattering, refraction etc., hence lower insolation values over the poles.

Candidates show:

L3: clear and detailed understanding of the issues. Analysis is to the fore and the points made are well supported with relevant evidence. **[5–6]**

L2: a limited range of valid points with some analysis. Provides support for some observations / somewhat lacking in evidence. **[3–4]**

L1: little knowledge and understanding of the topic. Little or no attempt at analysis; the approach may be largely descriptive with limited reference to evidence. **[1–2]**

L0: no creditable response. **[0]**

EITHER

(b) (i) Evaluate the contribution of different air masses to the climatic variability of a cool temperate western maritime climate. [15]

Indicative content

The question involves knowledge of the air masses which influence the UK's weather which is probably the example which will be used. However, it is important that the answer is not an exposition of each air mass in turn with its attendant weather conditions. The key word in the question is variability. This may be temporal variability i.e. the differences on a daily, seasonal and annual basis. It could also include variability within a weather system such as a depression. There is a difference between the warm frontal and cold frontal areas and then intervening warm sector. It is likely that candidates who recognise both elements of climatic variability will be achieving level 3 or 4 in their answers. There should be knowledge of both single blocking anticyclones and depressions which combine at the conjunction of Tropical Maritime and Polar Maritime air along the polar front. Links to upper atmospheric conditions and the associated weather will characterise the best answers.

Higher level answers will demonstrate a comprehensive knowledge of the air masses and their attendant weather and appreciate the idea of temporal variability, and the best will refer to the changes within a depression. Candidates may conclude that depressions (because they involve the conjunction of two air masses) tend to produce the greatest variability and that jet stream activity tends to dictate the occurrence and frequency of blocking anticyclones which can last up to two weeks. These produce settled benign weather rather than the wet, windy, changeable conditions associated with depressions.

Lower level answers will tend to narrate an exposition of each air mass and the weather associated with it without a great deal of recognition of the idea of variability. The use of terminology may not be well developed and any appreciation of the role of upper atmospheric processes may be less well understood, if it appears at all.

OR

(ii) To what extent does the tropical monsoon climate provide opportunities for, and constraints on, agriculture and water supply? [15]

Indicative Content

The tropical monsoon climate in Asia is characterised by one hot, wet, and therefore humid season and one hot, dry season. The onset of the monsoon rains occurs in mid-June: often the date can be precisely defined. However, more recently the onset of the rains has been less certain, occurring earlier or more usually delayed. Reasons for this may be hinted at but long explanations about climate change/global warming are not needed. Human activities tend to be guided by the weather conditions, especially agriculture, upon which the majority of the population depend.

Consideration needs to be given to floods and droughts, both of which are hazards which influence farming and the livelihood of so many. Details about constraints and opportunities will depend upon the case studies and may vary considerably as a result.

It is likely that flooding and drought and the impact upon farming will form the cornerstone of most answers, which is acceptable provided there is reference to both aspects of the question. The predominance of rice cultivation and now wheat in India, the impact of the Green Revolution and increased crop yields make the crop even more dependent upon availability of water. It may be that the human aspects of agriculture and water are inter-linked: that is fine provided most/all aspects of water supply are considered.

Higher level answers will include both aspects even if there is not a perfect balance of focus, an appreciation of the specifics of the climate, and even rainfall figures and place may be quoted in the best answers. An appreciation of both opportunities for (the positive) and constraints on (the negative aspects of the climate) will be mentioned in good responses. Nevertheless, these answers will demonstrate knowledge of the climate and some physical processes and the impacts which may result from their extremes, e.g. flooding, and drought. The best will see the links between agriculture and water supply in relation to the climate.

Lower level answers may demonstrate some knowledge of the tropical monsoon climate, its location and the weather associated. Failure to address the question and apply the weather and seasonal variation to the opportunities for and constraints on both these aspects of the human environment may characterise these responses.