CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the May/June 2015 series

9696 GEOGRAPHY

9696/23 Paper 2 (Advanced Physical Options), maximum raw mark 50

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CAMBRIDGE
International Examinations

Tropical environments

Only one question may be answered from this topic.

1 (a) Describe and explain the distribution of temperature and rainfall in the seasonally humid tropics. [10]

This should be in terms of latitude and the movement of the ITCZ and air masses leading to the climatic characteristic of well marked seasons. Distance away from the equator will reduce rainfall total and reduce the length of the rainy season. Good candidates will give data such as 600–1200 mm rainfall with most occurring within three to four months. In N. hemisphere, temperatures peak in May before the main rains (c.35ºC) and are lowest in January (c.25ºC). Extra detail will include references to the overhead sun, maximum insolation, low pressure, convergence, strong convectional uplift and heavy afternoon rain/thunderstorms.

(b) For either a tropical rainforest or a savanna ecosystem, explain the effects on nutrient cycling by different types of exploitation. Evaluate ways in which your chosen ecosystem might be sustainably managed. [15]

A sensible start would be to present a Gersmehl type diagram of an undisturbed ecosystem and explain how different types of exploitation would affect stores and flows of nutrients. Shifting cultivation, clear felling and agroforestry would have different impacts; the extreme case of clear felling leading to removal of most biomass, increased run off and leaching, i.e. reduced nutrient stores and loss of nutrients from the ecosystem. Sustainable management should follow on naturally with an understanding that nutrients need to be maintained and/or supplemented. Agroforestry, where trees and crops are grown together, could maintain soil structure and with rotation could maintain nutrient levels. Ecotourism may well feature but an appreciation of scale is needed, others will suggest prohibition of clearance to preserve the TRF as a resource linked to its role in absorbing CO2, etc.

For the savanna, game reserves might conserve the ecosystem but managed pastoralism, alternative energy to conserve forest and managed water resources might figure. Quality of evaluation to show genuine understanding may be lacking in many answers.

Level 3
Accurate knowledge of nutrient cycling in the TRF and good understanding of how affected by different types of exploitation. A scheme, or schemes, of sustainable management clearly presented with apposite evaluation. [12–15]

Level 2
Descriptive rather than explanatory and limited examples of exploitation. Appropriate sustainable management but less detailed and/or evaluated at the lower end of the level. [7–11]

Level 1
Limited to slash and burn and wholesale clearance/destruction with poor understanding of nutrient cycling. For the second demand: laws to limit clearance and afforestation with little or no evaluation. [1–6]

For no response, or no creditable response, 0.

2 (a) **Fig. 1 shows the formation of tors in a tropical environment.**

Explain the factors and processes that lead to the development of tors in a tropical environment. [10]

The factors are granite, jointing, climate and vegetation. Processes are deep chemical weathering (hydrolysis) from humic/CO2 acidulated water followed by erosion. The diagram shows closely spaced joints where maximum deep weathering has occurred and rounded core stones from chemical weathering by hydrolysis (break down of the feldspars in granite). The high temperatures and rainfall of the tropical environment combined with CO2 and humic acids from dense vegetation accelerate processes. Finally, uplift or climate change result in stripping of the accumulated regolith by erosion to expose the tors.

If no diagram: max. 6 marks.

(b) **Describe the vegetation structure of <u>either</u> the tropical rainforest <u>or</u> the savanna ecosystem. For your chosen ecosystem, explain how the vegetation structure may be affected by relief, soils and human activities. [15]**

The question states 'vegetation structure' but many candidates will write in terms of 'plant communities' (syllabus term) or the nature of the vegetation. Candidates who answer purely in terms of structure may gain full credit but where the emphasis is on plant communities there will no doubt be strong 'structure' elements which could also earn full credit. For the TRF expect the division into top canopy of 30 m and under canopy of 20 m with emergents up to 50 m. At ground level there is a shrub layer and then epiphytes and saprophytes. For the savanna, some may refer to a transition from TRF to the desert margins; closed savanna with trees and grasses to more open savanna with shrubs and tufted grasses.

The second demand could be less straightforward and human activities will probably dominate; TRF clearance and shifting cultivation leading to secondary forest and grazing and burning in the savanna. Some may refer to climax and plagioclimax communities which may only be marginally relevant. Intense leaching of soils leads to a loss of nutrients which may affect vegetation. Relief will influence the movement of water and perhaps instability of slopes that may affect vegetation.

Level 3
Accurate and comprehensive knowledge of vegetation structure. Well illustrated examples of how relief, soils and human activities affect the structure of vegetation. [12–15]

Level 2
Good description of the vegetation structure of the chosen ecosystem but with some lack of accurate detail. Nature (plant communities) rather than structure at the lower end of the level. Relevant effects of human activities but soils and relief limited. [7–11]

Level 1
Structure and plant communities with limited accurate detail. Limited response to second demand and only in terms of basic human activities. [1–6]

For no response, or no creditable response, 0.

Coastal environments

Only <u>one</u> question may be answered from this topic.

3 (a) Photograph A shows a coral atoll in the Caribbean Sea.

Describe the conditions needed for the growth of coral and explain how an atoll, such as that shown in Photograph A, could develop. [10]

The conditions will probably have been well rehearsed and differentiation will come from both the coverage and the degree of accuracy of the data provided. Coral reefs and the zooxanthellae algae living within the cell walls of coral polyps must have adequate sunlight and warm salt water (35–38 ppt) no colder than 18ºC (optimum 23º–29º). Coral reefs survive best in the waters between 30º N & S. They also thrive in clear, well oxygenated waters with little or no floating particles that can filter out or block direct sunlight (maximum depth of 80–100 m in the clearest oceans, more often 40 m). Coral reefs and the zooxanthellae algae living within the cell walls of coral polyps must have adequate sunlight for photosynthesis.

Development of an atoll will probably be explained with reference to Darwin's theory, although Daly and Murray may well figure. Well annotated diagrams could fulfil the requirement but realistic understanding and fine detail are needed for full credit such as the outward growth of reefs as lagoons receive more sediment and coral growth keeping pace with subsidence (coral can grow up to 10 cm per year). Daly's theory involving glacial eustatism has often been much misunderstood in the past.

(b) To what extent are rock type and rock structure the main influences on the morphology (form) of coastal landforms? Support your answer with reference to different coastal landforms. [15]

Marine erosion and sub-aerial processes must act upon the rocks and structures to produce the variety of landforms. At the most basic level there will be headlands and bays developed in nothing more precise than 'hard and soft' rocks and followed by the 'cave, arch, stack and stump' sequence. At the other end of the scale will be answers with examples of specific geology: different rock types, joints, faults and strata orientation. There will also be an understanding of the rates of sub-aerial weathering, erosion and mass movement balanced against that of wave erosion and removal.

Level 3
Genuine attempt to evaluate with well chosen examples to demonstrate the relationship between factors and processes in the development of a range of coastal landforms. [12–15]

Level 2
Good knowledge of marine erosion and a range of landforms but some lack of accurate detail and/or balance between marine and sub-aerial processes. Minimal evaluation of the factors. [7–11]

Level 1
Does not get much beyond 'hard and soft' rocks with headlands and bays together with caves, arches, etc. Very limited or no understanding of the role of sub-aerial processes and lacking evaluation. [1–6]

For no response, or no creditable response, 0.

4 (a) **Explain how the interaction of winds, different types of breaking waves and longshore drift can lead to the development of spits and dunes along a stretch of coast. [10]**

Constructive waves will push sediment onshore to build up beaches and wind direction will determine the angle at which waves break. A prevailing wind will lead to movement of sediment via LSD in a set direction which could lead to spit development and so on. Good answers will bring in refracted waves to give recurves and many will refer to the influence of secondary winds. Strong onshore winds over exposed beaches at low tides can lead to coastal sand dunes. Destructive waves will comb beach sediments offshore to create an offshore bar. Much can be achieved by well executed and annotated diagrams.

(b) **Explain the problems of management of a stretch, or stretches, of coastline that you have studied. Evaluate solutions, or possible solutions, to these problems. [15]**

There will be well documented accounts of coasts such as Holderness, East Sussex and Christchurch Bay. However, there have been developments of centre-based fieldwork studies. No special credit for these but generally they will demonstrate more accurate knowledge and understanding. The inclusion of a map showing prevailing and dominant winds and fetch as well as areas of erosion or accretion will add to such studies. Coastal erosion will no doubt be the main problem but over-use or destructive use by human activities in areas such as coral reefs, salt marshes/mangroves, dunes and spits may figure. The problems should be outlined and specific solutions described and evaluated. They could be an account of measures in force, such as hard or soft engineering, or suggested solutions. Evaluation in terms of outcomes is an important demand to be met.

Level 3
Accurately developed case study, or studies, with a clear explanation of problems facing coastal management. Actual or possible solutions will be described and evaluated. [12–15]

Level 2
Less specific, or accurate, explanations and principally of coastal erosion. Solutions exclusively hard engineering at the lower end of the level. Evaluation also limited at the lower end. [7–11]

Level 1
Lacking specific stretch of coast and mainly an account of groynes and gabions, etc. Evaluation, if any, very limited to costs. [1–6]

For no response, or no creditable response, 0.

Hazardous environments

Only one question may be answered from this topic.

5 (a) Explain the occurrence of two different types of volcanic eruption and describe the nature of their products. [10]

A range of terms may be used to define: Icelandic, Vesuvian, Hawaiian, etc., but essentially there should be a distinction between explosive eruptions and effusive ones. Some may distinguish between fissure eruptions and central vent ones. The crux of the question is to explain occurrence and describe the nature of products. Occurrence will be in terms of plate boundaries and hot spots. Nature of their products should involve acidic/andesitic and basic magmas/lavas and then the range of tephra, pyroclastic flows, ash and gases. Some may include secondary products such as lahars which could be acceptable depending on the context.

(b) Explain how and where tsunami occur. Describe how they become hazardous and evaluate the extent to which their hazardous impacts may be reduced. [15]

'How' is by a violent displacement of an ocean bed, most commonly by earthquakes but also possible by volcanic eruptions, such as Krakatoa, or major landslides. 'Where' would be in oceans such as the Pacific and Indian and some may detail examples, or location could be in terms of plate boundaries. They become hazardous as a tsunami wave approaches a coast and their enormous energy builds up monstrous waves as their wave lengths are compressed. As they can affect long stretches of coastline, inevitably populated areas will suffer major impacts. There will be plenty of events over the last decade to exemplify their hazardous impact.

The extent to which their hazardous impact may be limited could well depend on the height of the tsunami waves; high sea walls may well be breached or overrun. Planting mangrove and building coastal housing on stilts, etc. have been effective in Bangladesh against the similar impact of storm surges. Otherwise, prediction, warning and evacuation are important and detail of the Hawaiian monitoring centre may well be cited. Education, restricting coastal development and a range of response measures could be relevant as well as secondary impacts such as disease, polluted soils, destruction of fishing fleets and so on. Credit will be on understanding and evaluation, not quantity, and a good balance between the physical and human aspects.

Level 3
Comprehensive and accurate knowledge of the physical factors and processes. Well balanced, exemplified, evaluative and realistic understanding of how impacts may be limited. [12–15]

Level 2
Sound knowledge of 'how and where' with limitations at the lower end of the level. Relevant examples but with less evaluation and/or coverage of impacts. [7–11]

Level 1
Weak knowledge of how tsunami generated or develop to become major hazards. Examples but poorly focused on the specific impact of tsunami or how the impact of tsunami may be limited. A 'catchall' response to hazards in general in some cases. [1–6]

For no response, or no creditable response, 0.

6 (a) Explain how and where tornadoes develop and describe their effects on lives and property. **[10]**

Tornadoes develop along a boundary between cold air and warm moist air where there is a violent uplift producing thunderstorms. Tornado Alley will no doubt be cited where warm Gulf air meets either cold Arctic air from the north or from the Rocky Mountains to the west. Exact formation is complex, involving uplift and shearing to impart a spin at one level and then reversed at higher levels by the jet stream. The key element is a vortex of rapidly spinning air descending from a thunder cloud and making contact with the ground. The centre of the tornado has extreme low pressure. Around the funnel of rising air are very strong winds often over 300 kph. Their effects are limited in aerial extent from the narrowness of their tracks, often less than 50 m, and their short length of 2–4 km. However, in that relatively small area, effects on lives and property can be devastating; lorries and heavy machinery can be lifted and carried through the air for up to 300 m, buildings are destroyed with often considerable loss of life.

(b) Photograph B shows a major mass movement and its impact.

Describe and explain the mass movement shown in Photograph B. To what extent can the hazardous impacts of this and other types of mass movement be reduced? **[15]**

The mass movement is a landslide with a major slippage scar on the right and massive slumping to the left. Explanation would best be achieved by a cross-section diagram showing the principal elements with suggestions that the event might be triggered by heavy rainfall coupled with the weight of buildings on the slope. Some may suggest an earthquake but for no credit unless linked to elements of the slope. The hazardous impact should also be easily identifiable.

'To what extent', etc. might be to prohibit building on the slope or grading or draining it. Other types of mass movement may well include avalanches and mudflows/lahars reduced by afforestation or terracing of slopes, diverting structures, hazard zoning, etc. The case for prediction and evacuation may be made but will in most cases not be relevant for these types of hazard, i.e. 'To what extent' should be addressed.

Level 3
Accurate descriptions and explanation of the first demand. Realistic, detailed and well exemplified and evaluated response to reduction of hazardous impacts. [12–15]

Level 2
Identifies a landslide with some understanding of a mechanism for slope failure. The impact well described and some relevant responses to reduction of impacts but lacking accurate detail and/or any evaluation at the lower level. [7–11]

Level 1
Landslide identified but very limited, if any, explanation of a cause apart from too much building on a slope. Impact described but measures to reduce hazardous impacts unrealistic in most cases and poorly, if at all, evaluated. [1–6]

For no response, or no creditable response, 0.

Arid and semi-arid environments

Only <u>one</u> question may be answered from this topic.

7 (a) Describe and explain the global distribution of hot arid environments. [10]

Basically between 20º and 30/35º north and south of the equator and extending inwards from the west coasts of continents; extensive across Africa and Australia but restricted by mountain ranges in North and South America. Explanation should be in terms of the descending limb of the Hadley cell, the 'offshore' movement of the trade winds, continentality/rain shadow effects and the influence of ocean currents. Differentiation will be from the degree of accuracy and depth of understanding. Comprehensive coverage is not required for full credit; generalisation of distribution with selected exemplification will probably be the hallmark of the best answers.

(b) Fig. 2 is a block diagram of hot desert landforms.

Explain and evaluate the factors and processes, both past and present, that have operated to develop hot desert landforms as shown in Fig. 2. [15]

The landscape is essentially a relic one with present processes restricted to occasional flash floods choking the wadis and adding sediment to the alluvial fans. Intermittent streams may cross the pediment to the playa lake adding salts after evaporation. However, there is an opportunity to explain the development of the landforms in terms of weathering and fluvial processes. Wadis and alluvial fans should be straightforward; deep valleys eroded in a past wetter climate and deposition of sands and gravels as alluvial cones and spreads at the reduction of gradient. The mountain front is a boulder controlled slope which has undergone parallel retreat. The pediment might be explained as a basal slope left by active recession of the mountain front or as a result of lateral planation by running water which undercuts the mountain front causing it to recede. Weighing past against present day scale of the processes should be the hallmark of good understanding.

Level 3
Accurate knowledge of all of the landforms and clear understanding with evaluation of the role of factors and processes operating and which have operated in the past. [12–15]

Level 2
Good knowledge of wadis, alluvial fans and playas but less secure in explanation of others. Appreciation of the role of past pluvials but lack of evaluation at the lower end of this level. [7–11]

Level 1
Limited explanation of alluvial fans and wadis and playas in some cases. Muddled understanding of the role of past versus present scale or operation of processes. [1–6]

For no response, or no creditable response, 0.

8 (a) **Explain ways by which plants have adapted to survive the extreme temperatures and drought of hot arid environments. [10]**

The question demands different plants which means at least two need to be explained and could earn full credit if done well. Cactus, a succulent, will feature in most answers but detail is required; they must be able to absorb large quantities of water in a short time, only possible if soil is wetter than their interiors and achieved by extensive but shallow root systems. Reduced surface areas and waxy cuticles help conserve water and sharp thorns protect against animals. Desert shrubs and trees may be drought tolerant, often appearing as dead dry sticks but in fact alive, i.e. are in a state of deep dormancy. Many drop leaves to reduce transpiration but some retain leaves with a waxy coating such as the creosote bush. Desert trees and shrubs have extensive and deep root systems covering the extensive areas between plants. Dormancy is another adaptation such as the desert sunflower where seeds may lay dormant through several seasons until rains provide for a sudden growth and blossoming.

(b) **For an area of <u>either</u> an arid <u>or</u> a semi-arid environment that you have studied, explain the problems of sustainable management. Evaluate attempted or possible solutions to these problems. [15]**

Such a study is a requirement of the syllabus but all too often answers are not sufficiently focused. There needs to be a clear indication of which environment is being addressed and the problems well documented; climatic and edaphic and their impact on vegetation, and then on sustainable management of agriculture or pastoralism. Desertification could be a common 'problem' approach. Rising populations in semi-arid areas puts increasing demand on the limited natural resources.

Evaluation of attempted or possible solutions should be firmly based on an area studied but there may be an assortment of generalisations, some improbable or unfeasible. In LEDCs, changes to agricultural practices such as the introduction of drought resistant crops and paddocking of livestock have proved moderately successful. Development of a basic electricity grid, improved techniques of irrigation and water extraction from deep wells have enabled sustainable land use, from both governmental and NGO funding. Game reserves linked to tourism may have some value but may have a negative impact on sustainability of livelihood for local populations such as the Masai. Examples of successful sustainable management may be drawn from MEDCs such as Israel and Gulf states. The exploitation of mineral resources such as oil could be significant if channelled into development.

Level 3
Relevant and accurate explanation of problems, both environmental and human. Well documented area and evaluated solutions focused on sustainability. [12–15]

Level 2
Addresses appropriate problems but with some lack of fine detail at the lower end of this level. Less specific solutions or feasible ones with limited evaluation. [7–11]

Level 1
No clearly defined environment or area and limited and imprecise statement of problems. Solutions in terms of basic ideas such as irrigation, development of industries and tourism, plant trees, etc. without understanding or evaluation. [1–6]

For no response, or no creditable response, 0.