CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2014 series

9696 GEOGRAPHY

9696/22 Paper 2 (Advanced Physical Options), maximum raw mark 50

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CAMBRIDGE
International Examinations

Tropical environments

1 (a) Fig. 1 shows the monsoons of South-east Asia and Australia.

Explain how the monsoons shown in Fig. 1 occur and describe the weather they produce. [10]

Monsoon means seasonal and is caused by a seasonal change in pressure over south-east Asia. In (a) the sun is overhead in Australia causing the development of low pressure whilst over Asia the winter produces cooling and the development of high pressure. Winds therefore blow outwards, causing dry conditions over much of Asia. Australia on the other hand will have onshore winds bringing more moist conditions from the NW monsoon. In (b) the great heating of the Asian continent in summer and the high mountain barrier of the Himalayas allows the equatorial rain system to move northward and moist air to be drawn over India as the SW monsoon Moist air is also drawn into the low pressure area over China forming the SE monsoon.

(b) Explain the operation of nutrient cycling in tropical rainforest and savanna ecosystems. How might nutrient cycling affect attempts at sustainable management in <u>either</u> the tropical rainforest <u>or</u> savanna ecosystems? [15]

The nutrient cycles can most effectively be shown by appropriate Gersmehl diagrams. The TRF should show the large biomass store with nutrient inputs from climatic sources. The flows are rapid due to the climate resulting in smaller stores of litter and soil. Soil has losses from leaching whilst litter is limited by the rapid decomposition and uptake by the biomass. Soil and litter stores are relatively larger in savanna areas with a less rapid uptake by the smaller biomass. Vegetation is limited by the aridity experienced in the dry season although allows greater nutrient stores provided by the soil and litter. The breaking of the nutrient cycle by human interference in terms of management can have deleterious consequences. Most will choose an example(s) drawn from the TRF. These should, however, make due reference to nutrient cycles.

Level 3
Good understanding of both TRF and savanna nutrient cycles. The discussion of sustainable management will take due regard of nutrient cycles. **[12 – 15]**

Level 2
TRF nutrient cycle accurately portrayed, although savanna may be more vaguely expressed. More development than sustainable management but some attention given to nutrient cycling. **[7 – 11]**

Level 1
More on vegetation than nutrient cycling accompanied by accounts of the destruction of vegetation mostly in the TRF. **[1 – 6]**

For no response or no creditable response, **0.**

2 (a) Explain the development of deep weathering profiles in humid tropical areas. [10]

Deep regoliths are often of 30–60 m depth. Exposures of solid rock are relatively infrequent thus there are limited opportunities for mechanical weathering and chemical weathering is the dominant process. High temperatures speed chemical reactions. There is an abundance of soil moisture aiding the chemical processes. Dense vegetation supplies decaying vegetable matter giving rise to humic acids. The regolith is held in place by vegetation. Weathering rates are generally greater than transportation or erosion allowing accumulation. Deep regoliths are mainly found on crystalline rocks such as granite.

(b) Describe the weathering processes that occur in areas of tropical limestone. Explain the extent to which these processes have shaped the landforms in tropical limestone areas. [15]

Carbonation and its operation should be fully explained as should the influence of bedding planes and jointing in the limestone. Attention should be given to the humid tropical climate which allows faster reactions and plentiful supplies of acidulated water. The large amount of vegetation also supplies humic acids. All of this encourages intense vertical solution. Many deep hollows and dolines develop which can grow into cockpits with steep rocky walls separated by conical hills (cockpit karst). In more advanced stages of development tower karst may develop. These tower like structures are produced by solutional undermining once the cockpits have been deepened to the level of the water table and their floors permanently moistened. Hill slopes are thus continually undercut and steepened.

Level 3
Accurate description of the weathering processes, limestone and an appreciation of the impact of climate. The development of karst should concentrate on tropical landforms. **[12 – 15]**

Level 2
Weathering processes accurately developed although tropical context less emphasised. Landforms have some tropical elements but are often more generic. **[7 – 11]**

Level 1
Some carbonation but poorly explained in terms of rock characteristics and climate. Landforms mainly underground and generic. **[1 – 6]**

For no response or no creditable response, **0.**

Coastal environments

3 (a) Fig. 2 shows the operation of some marine processes along a coastal area. Describe the processes shown in Fig. 2 and explain how these processes contribute to the formation of coastal landforms. [10]

A straightforward diagram but one that shows a number of different elements that many candidates roll together. The waves are shown approaching the coast at an oblique angle with an offshore longshore current. This allows the development of beach drift with the swash repeating the wave angle whilst the backwash is at right angles. Thus material is moved along the beach and transported along the coast. The resultant landforms are drift aligned beaches, spits and barrier beaches. These can be explained by the cessation of the transportation due to the slackening of the current due to such things as coastal change of direction, estuaries etc.

(b) Describe the characteristics and distribution of coral reefs and atolls. To what extent are the conditions in which coral develops threatened by natural stresses and human actions? [15]

The nature of coral (calcium carbonate exuding polyps) creating reefs over very long periods of time and types of reef (fringing, barrier atoll) should be described and their distribution in tropical waters outlined. Threats are those that alter the sensitive conditions needed for coral growth and development. Natural stresses come from storms, seismic activity, freshwater intrusions and predators such as the crown of thorns starfish. Human activities could lead to ocean warming and hence bleaching. Pollution from land based activities such as agriculture, industrial development etc. Overfishing and removal of coral and coral sand. Impact of shipping inside barrier reefs. It is usually assumed that human activities contribute most to the decline in tropical coral reefs as there is normally a cycle of recovery from most natural threats (e.g. 10 year recovery from storms) whereas most human changes to conditions are more difficult to limit.

Level 3
Good description of coral and reef structures. Threats seen in terms of the conditions necessary for the healthy existence of coral. **[12 – 15]**

Level 2
Nature of coral described with general account of reef types. Tendency to develop the conditions required for coral growth rather than the impact of threats which are almost entirely the result of human activities. **[7 – 11]**

Level 1
General account of coral reef types with only human activities as a threat. **[1 – 6]**

For no response or no creditable response, **0.**

4 (a) Explain how rock type and rock structure can affect the formation of coastal landforms. [10]

Rock type can impact upon both the plan and profile of coasts. Thus more resistant outcrops will appear as headlands as the marine and sub-aerial processes make less headway than in the case of less resistant rocks in producing bays. Similarly various cliff profiles are mainly the result of geological type and structure. This can be illustrated by diagrams. Similarly rock type will influence the supply of sedimentary materials. All however work in conjunction with marine and sub-aerial processes.

(b) Describe the main types of management strategy that can be used to protect coastlines. Using an example or examples of coastline management, assess the effectiveness of such strategies. [15]

The question specifies management strategies, that is intervention (hard and soft engineering), do nothing, and managed retreat. Most will concentrate on the former and many will get no further than methods of coastal protection through the agency of engineered objects such as the ubiquitous groynes, rip raps, gabions, sea walls and the like. Many will merely assess the methods they have outlined with only vague reference to any particular coast and certainly will not assess them within the context of a management strategy. An answer that does assess strategies within a managerial context should receive due credit even if the types of methodology are limited. For example if an example of managed retreat was selected.

Level 3
Development of different types of strategy rather than merely methods of coastal protection. Apposite case study with good assessments. **[12 – 15]**

Level 2
Mainly methodologies of coastal protection but some idea of a management strategy. Examples tend to be more piecemeal. **[7 – 11]**

Level 1
Groynes, gabions etc. briefly described with little indication as to purpose or success. Examples very vague without any management. **[1 – 6]**

For no response or no creditable response, **0.**

Hazardous environments

5 Table 1 shows a classification of hurricanes (tropical cyclones).

(a) Describe the ways in which hurricanes have been classified in Table 1. Explain the types of hazard produced by different categories of hurricane. [10]

The table categorises hurricanes by wind speed, height of storm surge, pressure and damage. Clearly the basis for the classification is potential for damage rather than meteorological considerations such as size, rainfall etc. Hazards are largely produced by wind speeds in terms of destruction of buildings, the amount of debris carried and the piling up of storm surges that leads to coastal flooding. Rainfall can produce flooding due to the impact upon catchments and mud slides due to the saturation of surrounding hill slopes.

(b) Explain how hurricanes form and where they most frequently occur. To what extent is it possible to predict the path of hurricanes and to limit their hazardous effects? [15]

A hurricane is a low pressure system that develops where sea temperatures are at or above 27 C. This feeds more moisture and energy into the system through evaporation, They occur in the N. hemisphere where cold air moving south from the Arctic meets warm air masses moving north from the tropics to create a circulating air mass. The cold air is forced to rise rapidly giving rise to towering cu-nb clouds. Bands of thunderstorms and cumulus clouds spiral round a storm centre forming a cloud free eye. They are typically 500–800 kms across and 15 km deep. In the **n.** hemisphere they occur July – October when sea temperatures are at their highest. They are outside the immediate equatorial area (little coriolis force) and move from east to west to impact largely on eastern coastal areas.

Forecasting and predicting the course of hurricanes remain problematic. Weather satellites can give adequate warning of the approach of a hurricane, but they notoriously change course over oceans. In the USA hurricane watches are given out which warn of the possible approach of a hurricane in 24–36 hours, hurricane warnings when a hurricane is imminent at which stage evacuation takes place. Even so the cost of damage and deaths from hurricanes such as Katrina can still be severe. The building of storm defences and hurricane proof buildings have been of limited value.

Level 3
Good understanding of the formation of hurricanes and where they occur. Realistic assessment of the efficacy of prediction and limitation of effects. **[12 – 15]**

Level 2
More on the nature of hurricanes than their formation although general location described. A lot on the hazard prevention though relatively little assessment of prediction. **[7 – 11]**

Level 1
Formation not extending beyond sea temperatures and more emphasis on hazards. Little on prediction. **[1 – 6]**

For no response or no creditable response, **0.**

6 (a) Explain how and where volcanic eruptions occur. [10]

Volcanic eruptions occur at plate boundaries – both constructive and destructive. They also occur at hot spots. Each should be briefly explained in terms of the processes of tectonic plate movement, subduction, magma chambers and different types of volcano. They are most frequently located along destructive plate boundaries such as the Pacific Ring of Fire. Mid-ocean volcanoes also occur along constructive plate boundaries or are associated with hot spots (magma plumes) such as Hawaii or Reunion.

(b) Why are some earthquakes more hazardous than others? To what extent is it possible to prevent the loss of life from earthquakes? [15]

Many earthquakes impact upon areas that are not settled. Assuming they impact upon heavily populated areas they can still vary considerably in their hazardous impact. This could be the result of physical aspects i.e. strength, distance from the epicentre, nature of the terrain (mountainous – landslips or sediments where liquefaction might occur). Human activities clearly can affect the impact of the hazards by poor building, lack of regulation etc. Time of earthquake can also be important. Prevention is impossible and prediction unlikely. Some precautions can be taken in terms of aseismic structures, flexible gas pipes and general preparation of the population and services.

Level 3
Physical aspects of earthquake hazards well developed demonstrating knowledge of the nature of earthquakes. Realistic assessments of the means taken to limit loss of life.
[12 – 15]

Level 2
Some awareness of the factors affecting the scale and hazardous nature of earthquakes. More emphasis on attempts to limit the effects of earthquakes. **[7 – 11]**

Level 1
The vast majority of the answer will be on accounts of earthquake effects and hazard limitation with such things as buildings on springs etc. **[1 – 6]**

For no response or no creditable response, **0.**

Arid and semi-arid environments

7 (a) Fig. 3 shows how soil erosion and degradation may occur in semi-arid environments. Using Fig. 3, explain the development of desertification in semi-arid areas. [10]

The progress from overpopulation through to soil degradation should be explained and has obvious relevance to the situation in the Sahel. It does not tell the whole story, however. Depletion of water tables through boreholes and subsequent effects upon water supply and soil moisture. The impact of droughts extending over a number of years will also impact upon vegetation and hence soil degradation. Similarly the diversion of water supplies as in the Aral Sea can also spread degradation and desertification. Much will depend upon the quality of the example(s) selected.

(b) Describe the nature of soils and vegetation in hot arid areas. To what extent do soils and vegetation in hot arid areas differ from those in semi-arid areas? [15]

Soils in hot arid areas lack structure, organic materials and horizons. The little soil moisture that exists is drawn upwards and may leave salt deposits. The loose surface is subject to wind erosion and transportation. The vegetation is adapted to drought as xerophytic or phreatophytic. Examples should be given. In semi-arid areas soils have more structure and organic matter. Due to the high temperatures and seasonal drought soil moisture movement is upward and can lead to laterisation. The vegetation is more varied than in arid areas but still displays adaption to periods of drought and sudden uncertain rains. Thus trees such as the baobab and acacia accompany grasslands. Many show fire climax adaptions in terms of seed germination.

Level 3
Good account of arid soils and vegetation with an effective comparison with semi-arid areas. Useful exemplification. **[12 – 15]**

Level 2
Good account of arid vegetation with some reference to soils. Semi-arid vegetation described but with little direct comparison. Soils rather underdeveloped. **[7 – 11]**

Level 1
Vegetation in arid areas little developed beyond cacti and soils as loose sand. Baobab trees characterise semi-arid with no or very little attention given to soils. **[1 – 6]**

For no response or no creditable response, **0.**

8 (a) Describe the processes of erosion, transportation and deposition by wind in the development of desert landforms. [10]

A fairly straightforward task of explaining the processes of wind erosion (abrasion), transportation (creep, saltation) and deposition. The landforms representing erosion could be yardangs, zeugans, mushroom rocks; transportation – deflation hollows. Deposition in sand seas and the various categories of dunes. A lot to cover so we cannot expect explanation and description in too much depth. There should, however, be some reference to processes.

(b) With the aid of diagrams, describe and explain the formation of wadis, alluvial fans and rock pediments. Assess the contribution of processes operating in the present and the past to their development. [15]

Wadis are deep canyon like features that penetrate the mountain front. They are steep sided and contain alluvial bottoms and are sometimes choked with debris. Alluvial fans usually extend in front of wadis along the mountain front. They are triangular in shape and composed of sand and gravels. The coarser material tends to be deposited at the top of the fan. Pediments are generally at base composed of rock although will have a veneer of sediments scattered across it. It comprises a gentle concave slope ranging in angle from 7% in its upper part to 1% in its lower.

All of these features can be ascribed to the action of running water. Intense stream flow in the wadis has created the canyon like features, whilst the emergence of the heavily loaded streams onto the pediment will deposit materials in the form of alluvial fans. Pediments are usually assigned to the action of stream floods occurring in front of the mountain front. This can plane across the rock surface. It may also be connected to the retreat of the mountain front. In a sense all of these are relict features as current levels of rainfall cannot support this amount of geomorphological work – even over very long periods of time. It is thus assumed that climatic change has vastly reduced the amount of rainfall which was far more prevalent at times in the geological past.

Level 3
Good diagrams with accurate description which may be in the form of annotation. Explanation of formation takes full recognition of past pluvial activities. **[12 – 15]**

Level 2
Wadis and fans described although pediments are less well developed. Similarly with the explanations although there is recognition of past water activity. **[7 – 11]**

Level 1
Only vague descriptions largely centred on fans. Explanation vaguely assigned to water in the past. **[1 – 6]**

For no response or no creditable response, **0.**