CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2012 series

9696 GEOGRAPHY

9696/21 Paper 2 (Advanced Physical Options), maximum raw mark 50

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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CAMBRIDGE
International Examinations

1 (a) Explain how the migration of air masses and the ITCZ (inter tropical convergence zone) can affect tropical climates.

The ITCZ represents a band of low pressure at the convergence of the trade winds, generally located in between the tropics. It demonstrates light and variable winds and intermittent heavy rain showers. As the thermal equator it will move with the seasons. The extreme positions occur in Feb - southern hemisphere 18°S over Australia and South Africa and 7°N in Eastern Pacific in August. It bring rains to semi-humid and even semi-arid areas (Sahel). Hence the uncertainty of its seasonal movement can bring about drought. Its mean positions give rise to tropical humid climates. It also has an impact upon monsoon climes but this will be more associated with the annual change of pressure belts. Incoming moisture laden winds occur when there is low pressure over India due to heating. **[10]**

(b) Fig.1 shows information concerning the destruction of tropical rainforests.
Describe and explain the effects of the different types of rain forest clearance and suggest ways in which the rainforest ecosystem might be more sustainably managed.

The largest clearance of rain forest is for small-holder agriculture. Due to the fact that the nutrients are largely held in the biomass and there is little input into the soils, conversion to cropping disrupts the nutrient cycling and thus the sustained cultivation of crops would require vast use of artificial fertilisers. Similarly, the removal of trees through logging will remove nutrients and any secondary growth will be smaller and less well developed. More sustainable uses could be through selective low intensity logging where some of the trees are left to maintain nutrient levels. Agroforestry, where trees and crops are grown together could aid cultivation and low levels of mechanisation would help preserve soil structures. Prohibition of clearance would require some level of financial compensation to the countries concerned who may view TRF as a resource to be exploited. **[15]**

Level 3
A good appreciation of the nature of nutrient cycling in the TRF and hence its impact upon clearances for differing purposes. Sensible suggestions for sustainable development – not merely total prohibition of clearance. More related to clearance purpose that global impact. [15-12]

Level 2
More descriptive of the diagram but with some appreciation of the role of nutrient cycling, if not spelled out in terms of each purpose of clearance. Sustainable use more limited to preservation of as much tree cover as possible. [7-11]

Level 1
Largely a repetition of the material contained in the diagram, with the consequences of global warming, species loss, etc of clearance. [0-6]

2 (a) Explain the different types of weathering that occur in humid tropical environments.

Chemical weathering is dominant in the humid tropics due to the high temperatures and ready supply of water. The high temperatures increase the rate and the water allows the introduction of the weathering agents into rocks. It is inhibited to some degree by the luxuriance of the vegetation such that much chemical weathering is most effective at depth giving rise to a basal surface of weathering. Rotting vegetation contributes humic acids. Mechanical weathering is less dominant due to vegetation and climate and is limited to biological weathering, dilatation (where surface is removed) and possibly some limited thermal fracture. **[10]**

(b) Describe the landforms found in tropical limestone areas. Explain the influence of climate, vegetation and rock structure upon the formation of these landforms.

A range of karst features are found in tropical areas including pavements and well developed karren (Madagascar). The most prominent features, however, are cockpit karst and tower karst. Cockpit karst (sometimes called polygonal) is ranges of hills of roughly equal height with intervening soil filled basins. Tower karst are tall pinnacle-like features with rounded tops and vertical overhangs. They are all the product of carbonation which exploits joints and bedding planes. Tower karst is produced by the upstanding strata of more resistant limestone. Similarly, cockpit karst develops where water has exploited fissures leading to the development of conical shaped basins with upstanding hills. Climate contributes heat for the chemical reaction (van't Hoffs law) and plentiful water. Vegetation can contribute humic acids as well as providing some surface protection Rock structure is important in providing ingress for carbonic acids and variations in resistance. **[15]**

Level 3
Carbonation will be explained as well as the impact of climate. The account will be more focused on tropical karst than just karst in general, although may include some general feature (poljes, sink holes, pavements, etc). Some appreciation of the roles of structure and vegetation. [12-15]

Level 2
A more general account of carbonation and the development of karst landforms. Climate will be seen to enhance the processes but limited on the role of vegetation and structure. [7-11]

Level 1
Outline of carbonation but the landforms largely restricted to caverns, stalactites, etc. Little appreciation of climatic or any other influences. [0-6]

Coastal environments

3 (a) Explain the factors that lead to the deposition of sediment in coastal areas.

Sediment in coastal locations requires sources, transportation and sinks (deposition). Sediment is derived from rivers, estuaries, beaches, cliffs, etc by erosion. It is transported by waves in suspension or by traction, etc powered by long shore currents. It is deposited where the current slackens such as where the coast changes direction or there is a decline in sea depth or there is an estuary. Good accounts should organise their material outlining the erosion of the source areas, the means of transportation and the location of deposition **[10]**

(b) Fig 2 shows the location of coral reefs that are under threat.
Explain how far the conditions that allow the growth and development of coral reefs are under threat.

Threats to coral reefs come from natural and man made occurrences. It is notable from the diagram that many of the most threatened areas are also populous or the centres of tourist activities**.** Coral is threatened because the delicate conditions needed for its existence become disturbed**.** That is sea water depth, temperature, pollution free, oxygenation, etc. This could be through bleaching due to changing sea levels, diseases of coral, predators (crown of thorns starfish) or invasive species. Storms, freshwater inundation and seismic events are ongoing natural threats.

Threats resulting from human activities include:
Pollution from deforestation, land use, sewage, and wastes in general.
Overfishing
Building of ports groynes, etc
Coral mining for building materials or souvenirs
Release of topsoil into sea from on land activities
Boating, snorkeling and other tourist activities **[15]**

Level 3
Good understanding of the threat to coral growing conditions with a reasonable coverage of types of threat related in some cases to map. [12-15]

Level 2
Some appreciation of how the threats operate upon conditions favouring coral growth and exemplification of some types of threat. [7-11]

Level 1
Little relationship to conditions of coral growth and threats limited to such things as fishing, boat mooring and pollution by the dumping of rubbish. [0-6]

4 (a) Explain how wave action can produce variations in the cross section and plan forms of beaches.

Most will see beaches as the result of constructive and destructive waves although the accumulation of beach material is due to long shore drift. Constructive waves with their stronger swash will push material up the beach increasing the profile/slope whilst destructive waves with their stronger back wash comb materials down lowering the slope. Coarser material is deposited on the upper parts of beaches and is usually only affected by winter storm waves. Minor changes to beaches, such as berms and runnels are the response to wave action. In terms of plan, refraction and drift will produce bay head and pocket beaches as well as features such as barrier beaches. **[10]**

(b) Using examples, explain why different stretches of rocky coastline produce different landforms.

Different landforms are produced along rocky coasts due to the interplay of weathering, marine erosion and rock type and structure. The latter is the most influential in that the level of resistance of the rock can produce a coast of alternate headlands and bays. Similarly massive jointed rock, such as granite or limestone will produce a steep cliffed profile in circumstances of high energy environments (long fetch). Thus the coast will undergo parallel retreat producing wave cut platforms and cliffs. The exploitation of structural weaknesses by weathering and wave action can attack headlands to produce caves, geos, stacks, stumps, etc. Rocks that are less resistant or structurally weak (weakly bedded sandstones, etc) will produce low cliffs and rapid coastal erosion. Cliff profiles will reflect both geology and sub-aerial weathering activity. **[15]**

Level 3
Appreciation of the factors that influence coastal erosion and landforms with an understanding of the vital role of rock type and structure. May well illustrate answer with exemplification of landforms and coastal stretches. [12-15]

Level 2
More attention to processes of marine erosion and landforms such as wave cut platforms stacks, etc. Limited awareness of the significance of geology, but not well related to landforms. [7-11]

Level 1
A random collection of landforms very loosely linked to the processes of marine erosion. [0-6]

Hazardous environments

5 (a) Fig. 3 shows some methods used to predict and monitor earthquakes. Explain how these methods can be used, and with what success, for earthquake prediction.

Satellites record changes and movement on the earth's surface. Strain meters measure the stretching and compression of the crust, water tables are thought to drop prior to an earthquake whilst radon gas can be released by rocks under pressure. Gravity meters record changes to gravity in rocks as they become stressed. Seismometers record shock waves from the epicentre and usually only occur once an earthquake is in progress, although some are thought to be preceded by a series of minor shock waves. Levels and laser reflectors record any movement along the fault line. None have been shown to be effective in providing any significant prediction far enough in advance of an earthquake to be effective. **[10]**

(b) Explain how and where earthquakes occur. Describe their hazardous effects and the extent to which action can be taken to limit these effects.

Earthquakes are sudden movements along fault lines in the earth's crust. They are due to the sudden release of accumulated tension in the fault and can be sited at various depths below the surface (foci). They are strongly associated with plate boundaries particularly the circum Pacific plate boundaries. Their frequency tends to match the rates of plate movement and they are often most intense when associated with subduction zones (eg through the Mediterranean and Aegean). The hazardous effects are produced by ground shaking and the collapse of buildings. They are thus most hazardous in urban areas. Liquefaction can add to building collapse and landslides and fires are further hazardous effects. Prediction allowing evacuation has not proved successful so protection by building regulation and education appear the best bets. Buildings should have strong flexible structures with adequate tying of ceilings and walls. This is expensive and widely ignored in LEDCs. Hence loss of life (eg Haiti).

[15]

Level 3
Good understanding of the nature of earthquakes and their links to plate tectonics. Effects more than mere building collapse and a realistic estimate of the effectiveness of protective measures. [12-15]

Level 2
Acknowledgement of movement along fault lines and their distribution in line with plate boundaries. More emphasis on the effects of earthquakes with often graphic description although limited in range. Earthquake proof structures emphasised. [7-11]

Level 1
Ground shaking with little or no association with plate tectonics. Mainly descriptive of an earthquake event or earthquake effects. [0-6]

6 (a) Explain the causes of hazardous mass movements.

The basic cause is slope instability either in terms of geology or snow conditions (avalanches). This slope instability can be triggered by sudden inputs of precipitation (hurricanes, etc) seismic activity (earthquakes), volcanic eruptions, weather conditions leading to snow melt (avalanches). Human activities also have significant inputs into slope instability as in the case of triggering avalanches and undercutting or overloading slopes through quarrying, waste or spoil heaps and the like. Quite a wide field so the better answer will be well organised. **[10]**

(b) Describe the measures that can be taken to limit the hazardous effects of mass movements and evaluate their effectiveness.

Prediction is very limited although the monitoring of weather could allow some warning in the cases of mass movements consequent upon cyclones, monsoon rains or snow melt in the case of avalanches. Earthquakes are notoriously hard to predict as are the likely impact of lahars from volcanoes. Some preventative measures can be taken in the case of avalanches, but in most cases it is the avoidance of settlement below unstable slopes. Thus planning regulation and the avoidance of human activities that overload or undermine slopes. Some minor actions can be taken by locally buttressing slopes, afforestation and the drainage of unstable areas to avoid saturation. Major events that are triggered by earthquakes or the impact of cyclonic rain have little means of prevention or amelioration. **[15]**

Level 3
A good appreciation of the range of mass movements and hence the problems of effective action. Avoidance will be seen as the best measure but a range of ameliorating factors considered. [12-15]

Level 2
A rather limited view of hazardous mass movements with a tendency to concentrate on one or two (ie avalanches or landslides). Limited assessment of preventative or limiting measures. [7-11]

Level 1
Descriptive of the effects of mass movements (eg mud flows, landslides) with mainly hard engineering solutions. [0-6]

Arid and semi-arid environments

7 (a) Describe and explain the characteristics of the climates of hot arid areas.

The characteristics of these climates are low rainfall (less than 250 mm) and high temperatures. Clear skies give rise to large diurnal ranges which are often greater than seasonal temperature ranges. Rainfall is infrequent, episodic, unreliable and convectional. These are high wind environments with low humidity and frequent dust storms. The causes are sub-tropical highs, rain shadow, continental interiors and influence of cold ocean currents. **[10]**

(b) Fig.4 shows some landforms in a hot arid environment.
Describe the landforms and explain their formation. To what extent are the landforms the product of present day geomorphological processes? [15]

The figure shows the landforms across a desert piedmont zone. Descriptions should be given of the mountain wall pierced by steep sided wadis, the alluvial area abutted against the mountain wall that is characterized by different types of stream flow, the angled pediment leading to a playa lake and finally some dunes produced by the wind borne deposits of the piedmont. The formation of these features is seen as derived from water activity, deposition and erosion. Streams emerge from the wadis as streamflow depositing their sediment with the loss of velocity on the pediment. The pediment is developed at a constant angle due to sheet floods and eventually the water enters a playa lake, which is usually ephemeral as the water evaporates leaving behind salt deposits. Dunes are shaped and deposited by winds utilising material gained from the surrounding areas. Current levels of precipitation would not allow the amount of activity required to produce features of this scale. Hence it is suggested that they are largely relict features of a Pleistocene pluvial period.

Level 3
Accurate description of the landforms with material additional to the diagram. Explanation in terms of water erosion and dune generation. Argument for past pluvials despite episodic water and ongoing wind activity. [12-15]

Level 2
Heavy dependence on the diagram for description with rather vague explanation of water erosion. More on dunes and playa lake with an acknowledgement of past pluvials but without any real reasoning. [7-11]

Level 1
Repetition of information on the diagram with little explanation or description. Most attention focused on dunes [0-6]

8 (a) Explain the causes of the degradation of soils and vegetation in semi-arid areas.

The degradation of soils in semi-arid areas is usually seen as the result of either drought and/or human activities. Drought is common in these areas and can operate in cycles. For example if the ITCZ fails to progress to the north, the Sahel may well receive little or no rainfall for a number of years. This can lead to vegetation loss and hence a lack of nutrients which allows the soil to dry out and be transported by the wind. Should drought end, recovery is possible. More serious is a combination of drought and increases in human occupation and overgrazing. These areas are very sensitive to over grazing which can rapidly lead to vegetation loss and consequent environmental deterioration. Increases in population means the felling of timber for fuel and building purposes with much the same consequences. Recovery is much more difficult and can lead to permanent desertification. **[10]**

(b) Using an example or examples, explain the extent to which it is possible to sustainably develop and manage either hot arid or semi-arid areas.

An opportunity to develop a case study to review either a case or cases of development or of anticipated development in one of these environments. Some will have prepared case studies of attempts to resuscitate degraded areas in semi-arid conditions, such as the Dust Bowl, Sahel or even Syria or South Eastern Spain or Australia. Arid areas will probably reflect more developments such as the Negev although some may anticipate the development of deserts as sources of solar energy that are now being proposed. Some attention should be given to the sustainability of any such development. **[15]**

Level 3
A well developed case study that not only charts any development but also assesses its impact within the environment and its long term sustainability. [12-15]

Level 2
Some detail of examples or case study of development, but only limited assessment of its success with little estimate of its environmental impact or sustainability. [7-11]

Level 1
Vague references to such things as irrigation by damming rivers (Nile) or reafforestation (Sahel). Little or no indication of how or when these might be brought about or any assessment made as to success. [0-6]