CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 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) Fig. 1 shows outline soil profiles for A, tropical rainforest and B, savanna ecosystems. Explain the factors and processes that determine the characteristics of tropical rainforest and savanna soils such as those shown in Fig. 1. [10]

The factors are climate, vegetation, soil organisms and lithology but the last may well be absent and not essential for full credit. The processes are weathering, leaching, illuviation, laterisation, calcification i.e. involving chemical reactions, solution and precipitation, transport and linked to the movement of soil water and temperatures.
For A: intense chemical weathering from high rainfall and temperatures as well as the contribution of humic acids from the luxuriant vegetation can account for the depth of soils of up to 30 m. Water movement is downwards through the soil and there is rapid leaching and laterisation; removal of silica and the resultant red Al and Fe sesquioxides. The rapid decomposition of the thick litter by soil biota gives a thin humus layer.
For B: less deep soil of 2–4 m and as savanna grasses die back and limited leaf fall occurs in the dry season there develops a thin dark brown humus layer. The essential difference, besides depth, is the seasonal movement of water with capillary action in the dry season leading to silica redeposition and calcification to create a hard cemented layer. The predominantly red soil is due to similar processes of leaching during the wet season.

Good answers will include detail of the two climates and some may show awareness that the soils can be of great age and, in the case of the savanna, of an earlier and more forested and wetter environment.

(b) For one tropical ecosystem, evaluate an example, or examples, of attempts at sustainable management. [15]

The example or examples of sustainable management within one of the ecosystems should have been well rehearsed. There is a wide range of possibilities but good answers will show appreciation of the environmental limits for effective management such as disrupting the nutrient cycle or even the closed water cycle. Expect selective logging, agroforestry, licensing, ecotourism, safari parks etc. The key issues are 'sustainability' as well as some 'evaluation'.

Level 3
Will show a good knowledge and an understanding of the factors and processes for the one ecosystem. Any scheme of sustainable management will be realistic, contain accurate detail and valid evaluation. **[12–15]**

Level 2
Less well balanced but showing appropriate levels of knowledge at the higher end but with limitations of detail and/or coverage at the lower end. Has an appropriate example of sustainable management but lacking some accurate detail and/or evaluation. **[7–11]**

Level 1
Limited knowledge of the ecosystem plus minimal understanding of factors and processes. Inappropriate or weakly presented example of sustainable management with little or no evaluation. **[1–6]**

For no response or no creditable response, 0.

[Total: 25]

2 (a) **Explain how the seasonal climatic characteristics of tropical monsoons are related to air masses, wind and pressure systems. [10]**

Will no doubt be answered in most cases with reference to SE Asia, but Australian or East African systems may appear as well as acceptable accounts of equatorial monsoons. Answers should include both the seasonal characteristics and meteorological circumstances. Understanding may well be demonstrated by annotated sketch maps or diagrams. Key elements are the seasonal differences determined by the movement of the ITCZ but with the E–W configuration of land and sea masses across S Asia and Australia accentuating pressure differences over the land and sea areas; e.g. the heating over the NW Indian sub-continent and central Asia building up high temperatures, and hence low pressure, from May onwards (hot dry season). The drawing north of moist Tm and Em air masses across the equator (SW Monsoon) leads to the high rainfall totals linked to relief and instability over heated land surfaces. The reversal of pressure and wind systems should be covered with, in the SE Asia case, HP build up over central Asia and the southward movement of the ITCZ and sub-tropical jet stream; i.e. the NE Monsoon. Top answers will give accurate detail of seasonal differences with some appropriate data.

(b) Describe granite landforms found in humid and seasonally humid tropical environments. Explain the extent to which weathering and erosion contribute to their development. [15]

Full credit could be gained for just two landforms, if of contrasting type and accurately described with appropriate understanding of their scale as well as morphology; probably clearly illustrated as well. Expect a selection from ruwares, tors/castle koppies, bornhardts/domed inselbergs. For the second demand, what is needed is: accurate detail of chemical weathering of granite and an understanding of the role of joints and joint patterns. Hydrolysis should be explained as the key weathering process operating along joints in the granite. The process will be accelerated under the hot wet climate and decaying vegetation and lead to a deep regolith and undulating BSW determined by the density of joints. Diagrams would be helpful in showing areas of core stones above unweathered granite masses between highly weathered areas of more intense jointing. Erosion comes into play with removal of the regolith by stream action working most effectively along the more weathered granite leaving upstanding masses, ruwares/bornhardts/inselbergs or areas of tors/castle koppies. Thus in evaluating the 'extent to which weathering and erosion contribute', the role of the composition and structure of granite needs to be assessed.

Level 3
Accurate description of both scale and morphology of at least two major landforms. Good evaluation of the roles of granite, weathering and erosion processes and joint patterns in the development of landforms. **[12–15]**

Level 2
Good descriptions of landforms; basic understanding of processes and the role of structure with some degree of evaluation. **[7–11]**

Level 1
Appropriate terms for a couple of landforms but weakly described/illustrated and limited or inaccurate knowledge of processes. No valid understanding of the role of structure. **[1–6]**

For no response or no creditable response, 0

[Total: 25]

Coastal environments

Only one question may be answered from this topic.

3 (a) Describe how coastal saltmarshes develop and explain the threats to such saltmarshes and how they may be sustainably managed. [10]

Saltmarshes develop by the accumulation of mud and fine sediment in sheltered locations, such as in estuaries or the landward margins of spits and bars. River muds are flocculated and settle in the still periods of high tide sea water. As silt and mud build up, the longer periods of exposure between tides allows the growth of algae and later halophytes (salicornia, samphire, sea lavender, spartina). Plants trap more silt/mud and eventually an area of semi-permanent 'sward' is created. Threats will include both physical and human activities: rising sea level, episodic storm events which may breach containing spits or sea walls, whereas human activities could result in destruction from pollution, overgrazing, and various types of development. Saltmarshes are often significant wild life refuges and in some cases natural barriers to coastal erosion. A range of methods might be considered for sustainable management including hard engineering to protect from marine erosion and conservation by public education, restricted access and controlled grazing etc.

(b) With the aid of diagrams, describe how cliffs and wave cut platforms develop. Explain the factors and processes which determine differences in the morphology (shape) of cliffs and cliffed coastlines. [15]

A sequence of well annotated diagrams could earn full credit for this part: initial slope into the sea, marine erosion leading to cliff retreat and leaving a WCP. The second part of the question demands organisation of material to present an account of the role of geology (structure and lithology) operated on by both marine and sub-aerial processes with clear exemplification, either actual coasts or credible models. The morphology of cliffs should include profile and will inevitably include the cave, arch, stack and stump sequence. Better answers will address the balance between the rate of marine erosion and removal against the effectiveness of sub-aerial processes lowering the cliff profile. Geology and structure will be significant with the inclusion of lithology (actual types), dip, faults and jointing being appreciated in the better answers. Cliffed coastlines will be in terms of headlands and bays with structure and lithology determining accordant and discordant types.

Level 3
Will show both accurate detail and mature understanding of cliff and cliff line development. Appropriately chosen examples and an understanding of not only the processes and factors involved but how they interact with each other. **[12–15]**

Level 2
Good account of cliff and wave cut platform development. Good range of processes and factors but limited exemplification and/or their interaction at the lower end of this level. **[7–11]**

Level 1
Simple model of cliff and wave cut platform development. Little beyond caves, arches etc. and basic headlands and bays. Weak exemplification in general terms such as hard and soft rocks. **[1–6]**

For no response or no creditable response, 0

[Total: 25]

4 (a) Describe the characteristics of different types of wave breaking on beaches. Explain how wave types and beach sediments affect beach profiles. [10]

Constructive and destructive waves will have been well rehearsed but clear and accurate understanding of how they affect beach profile and form is often lacking. Diagrams have often contradicted text in this. C waves, with lower height and longer wave length and periodicity, break with a surge so that the stronger swash builds up beaches with a steeper profile and creating ridges (berms). D waves have plunging breakers with a strong back wash and feeble swash resulting in the combing down of sediment, depositing longshore bars and leading to a gentler profile. Beach materials can range through boulders, cobbles, pebbles, sands, silts and clays plus organic remains such as sea shells. However a basic distinction between sand and shingle is sufficient for full credit. Boulders and pebbles can be thrown up by storm waves to create storm beach ridges on the back shore. Shingle beaches have steeper profiles than sand beaches as backwash is reduced by percolation with the reverse pattern occurring on sand beaches.

(b) Fig. 2 shows percentages of some of the threats to the conditions necessary for coral growth.

Explain the nature of the threats shown in Fig. 2. To what extent can these threats, and other threats to the continued existence of coral reefs, be overcome. [15]

The highest threat of ‘over exploitation’ both in amount and degree, is physical break up and includes fishing, especially by dynamite, cyanide and trawling, mining for cement production and tourism impacts for souvenirs and boating. ‘Land based’ pollution is both chemical and solid: nitrates from fertilisers, sewage and industrial effluents and stream sediment discharge; these impact on the conditions necessary for coral growth and survival. ‘Coastal development’ could embrace the previous two classifications with the impact of increased industrial activity, port installations and booming tourism infrastructure in such popular sub-tropical coastlines. Marine pollution is the least significant both in amount and degree: oil spills and discharge dominating.

The extent to which these and other threats e.g. rising sea temperatures and levels, increased CO2 of oceans and predators such as the crown of thorns starfish, can be overcome will mainly be by legislation and education. The former will involve policing and prosecution, designation of marine conservation areas. The latter by publicity via the media, notice boards and education in schools and colleges. Changed fishing practices and alternative sources of ‘limestone’ could have a major effect especially in East Africa and SE Asia. Measures advanced to meet the specific threats given should be evaluated as to ‘what extent’ they are achievable.

Level 3
A well balanced approach with accurate and detailed knowledge of the threats. A realistic understanding of overcoming threats with sound examples and evaluation. **[12–15]**

Level 2
Some limitation in knowledge of the nature of the threats with limited examples. Aware of some threats but understanding of measures and their effectiveness limited at the lower end of the level. **[7–11]**

Level 1
Lacking in knowledge of the specific nature of the threats under each heading. Other threats exclusively global warming without its potential degree of impact. Limited suggestions for combating the threats and no or very limited evaluation. **[1–6]**

For no response or no creditable response, 0.

[Total: 25]

Hazardous environments

Only one question may be answered from this topic.

5 (a) Describe how tsunami are generated and explain how they become hazardous in some coastal areas. [10]

Tsunami are generated by a violent displacement of the ocean bed by an earthquake or some major impact imparted to an ocean by a submarine volcanic eruption or landslide. Most will select the earthquake option and this is sufficient for full credit if well detailed e.g. the 2004 Indian ocean and 2011 Japan, both category 9 and with massive displacement along the plate boundaries and so on. Krakatoa generated a large tsunami and there are predictions of a cataclysmic tsunami event following a landslide from the Canary Islands. Almost unnoticeable in oceans, tsunami have a low wave height but extreme wavelength and can travel up to 700 km/hr. They become hazardous on approaching coasts as the upward sloping sea bed reduces their speed and their wavelength is decreased and transferred to wave heights of up to 30 m. There will no doubt be much detail of death and destruction well exemplified but key points are massive destruction and loss of life in extreme events where there are concentrated centres of population; but physical factors such as the off shore slope and amplifying effect of bay and estuary configurations could be relevant. Some will detail secondary hazards from disease, soil degradation and so on.

(b) Explain the distribution of those areas of the earth which are subject to the hazardous impact of volcanoes. Evaluate measures that may be taken to manage the hazardous impact of volcanoes. [15]

A basic statement is because they may be populated regions which are in close proximity to volcanoes. What is required is the relation of volcanic belts to plate boundaries, with hot spots as a bonus. The best answers will use examples such as the 'Pacific ring of fire', the mid Atlantic ridge, Hawaii and so on. They will also discriminate between the many non-hazardous eruptions and those that are, either because of location or because of the nature of the eruptions. Those at destructive plate margins being generally the most hazardous. The population aspect is relevant and best covered with examples, e.g. Pompeii etc. Prediction and the infrastructure to manage effective evacuation should be of paramount importance and accurate detail of methods and examples should be well rewarded. No volcano will erupt without warning signs and the key to prediction is recognising and measuring them. Swarms of small earthquakes and swelling of the ground surface reflect the passage of magma to shallower depths prior to eruption, hence the importance of seismic monitoring and the use of tilt metres or lasers. Similarly gravity changes can be significant. Gas discharges may damage vegetation and kill wildlife and there may be raised temperatures of ground and ground water springs and so on. In MEDCs global positioning receivers can detect ground swelling, temperature rises and gravity anomalies. The nature of eruptions should be considered such as the speeds of lava flows and the effects of ash falls; the use of water cooling of lava and diversion of flows by explosives and roof construction to hold up ash fall. Some reference to unpredicted events such as the Nevado del Ruiz eruption leading to a massive lahar, and the Lake Nyos crater lake carbon dioxide event. Other measures come into the 'catch all' list of preparedness, education, provision of rescue/first aid insurance and so on. These can be made relevant when specifically related to volcanic events.

Level 3
A suitably generalised global distribution well related to the principal types of plate boundary with reference to examples and including the human aspect. Detailed and accurate knowledge of a range of measures showing good understanding and evaluated. **[12–15]**

Level 2
Selective approach to distribution but with accurate knowledge of plate boundaries and the hazardous nature of volcanoes associated with them. Good knowledge of measures with a reasonable degree of understanding, with evaluation at the upper end. **[7–11]**

Level 1
Distribution linked to plate boundaries but with little development and limited in global coverage. Limited or no reference to the degree of hazardousness of volcanoes at different boundaries. Weak knowledge of measures with little or no evaluation. **[1–6]**

For no response or no creditable response, 0.

[Total: 25]

6 (a) Photograph A is a satellite image of a tropical storm 'hurricane Ivan'.

Explain how tropical storms develop and describe the hazards generated by them. [10]

The level of accurate knowledge together with understanding will differentiate the answers. They develop over warm ocean areas (>26 ºC) in a belt > 500 km N. and S. of the equator in late summer (when sea temperatures reach their maximum) and where the trade winds (NE and SW in N hemisphere) converge on the developing low pressure. The Coriolis effect produces the spin and intensifies the low pressure centre of the developing storm. Undisturbed upper atmosphere allows the development of the massive uplift and generation of elements of the system – diagrams may add detail to show the walls of cumulo nimbus clouds and central eye. The hazards are the high winds, intense and high rainfall and storm surges. Credit well those who add appropriate data and/or examples.

(b) For any one hazardous environment, what are the problems of sustainable management? Evaluate any attempted or possible solutions to these problems. [15]

Straight from the syllabus so candidates should have an appropriate case study to draw upon. In the first part there should be a clear analysis of the problems selected, and by convention, 'problems' plural, means two would strictly suffice. However it is the presentation of full and accurate detail that will count for the degree of credit awarded. The problems arise from the effect of an event and these should be presented and, hopefully, in order of significance. Loss of life and damage/destruction of property, infrastructure, farmland plus secondary hazards such as pollution and disease. Sustainable management will be by developing strategies in order for such areas to recover from events and reduce the impact of future such episodes. Solutions will be the oft listed examples of being able to predict hazards, preparedness, developing hazard resistant buildings and structures and so on. These should be specific to the choice of hazardous environment chosen, and be evaluated.

Level 3
A comprehensive and accurate knowledge of the potential hazards clearly applicable to the chosen environment. The problems arising will be assessed in accurate detail and solutions focussed on sustainable management and evaluated. **[12–15]**

Level 2
Some limitation in the range of hazards and lacking some detail of the resultant problems. Good range of solutions but lack of detail and appropriateness at the lower end of the level. Evaluation also limited at the mid and lower end. **[7–11]**

Level 1
After the selection of a hazardous environment, a standard response of applying a list of 'remedies' to its hazardous impacts. Limited relevance to the specific environment with minimal evaluation. **[1–6]**

For no response or no creditable response, 0.

[Total: 25]

Arid and semi-arid environments

Only one question may be answered from this topic.

7 (a) Fig. 3 shows the main hot semi-arid environments of the world.

For any one continent, describe the distribution of its hot semi-arid environments and explain the characteristics of the climate. [10]

The principal points are that they occur either side of the hot arid, i.e. hot desert areas. No doubt Africa will be the most popular and accessible choice with small areas along parts of the southern Mediterranean coast and the east-west Sahel strip south of the Sahara swinging south in East Africa. In the southern hemisphere it borders the Namib desert with patches on the southern tip of South Africa and western Madagascar. Australia provides the simplest pattern and we must take what we get from Asia and North and South America and assess it accordingly.

Explanation of the climatic characteristics should be in terms of the higher and lower latitude margins of the arid areas. Some will no doubt explain the climate in terms of that for hot deserts but having more rainfall and perhaps a lower diurnal range of temperature. However in the lower latitudes e.g. south of the Sahara, the climate comes under the influence of the ITCZ and has characteristics similar to the savanna with summer maximum rainfall within a total of between 250–500 mm but unreliable and occurring in often heavy convection storms. Temperatures range seasonally from 20–25° to 30/35° with a diurnal range of 15°C. In the higher latitudes the characteristics take on those of a Mediterranean type with a winter maximum mainly from occasional westerly moving depressions. Rainfall totals similar but generally more reliable. Temperatures will be some 10°C lower in both seasons.

(b) Explain the processes of desertification and soil degradation in semi-arid or arid areas. Evaluate any scheme to manage such areas sustainably. [15]

The wording of first demand in this question is taken straight from the syllabus. The processes should include both physical and human ones but many have, in the past, explained desertification almost entirely in terms of over grazing and over cultivation. In better cases deforestation to provide building materials and fuel for heating and cooking have been included. Physical processes derive from the low and unreliable nature of the rainfall with periodically long periods of drought; soils are deprived of moisture and become friable and with dying off of vegetation, exacerbated by human removal, and are prone to erosion both by wind and the sudden torrential rainstorms. In better answers, candidates will show awareness of both the physical and human processes.

Solutions to sustainable management will no doubt range from a list of improbable or unfeasible schemes to well evaluated case studies. Such might include highly sophisticated irrigation farming as practised in Israel, paddocking of grazing animals and schemes for dry farming techniques involving drought resistant crops and crop rotation and so on. Improved technology coupled with economic development, or aid, may allow for boreholes to tap deep water tables and provision of electric power may reduce dependence on foraging for firewood. Tourism will no doubt be advanced, but will it allow for sustainable management? Many schemes are exploitative and although providing some local employment may lead to displacement of pastoral groups such as the Masai and income generated leaving the area to boost profits of MEDC companies. Many will suggest mineral extraction and other industrial enterprises. These could be made relevant but need evaluation of specific examples.

Level 3
Will show a well balanced and very good knowledge and understanding of the processes of desertification. Solutions will be based on well documented examples and fully evaluated. **[12–15]**

Level 2
Will display good to average coverage of both physical and human processes with some limitations on soil degradation. Acceptable solutions advanced but with some lack of detail and/or evaluation. **[7–11]**

Level 1
Limited processes with major omissions and lacking appropriate knowledge of soil degradation and/or how desertification develops. Weak or unfeasible list of solutions with simple statements of evaluation if any. **[1–6]**

For no response or no creditable response, 0.

[Total: 25]

8 (a) **Explain the main weathering processes operating in hot arid and semi-arid environments and describe their effects on the disintegration of rocks.** **[10]**

Physical weathering processes will dominate but better answers will include chemical weathering processes and some will show understanding that they often act together. Insolation weathering from high diurnal temperature range with alternate expansion and contraction of rock surfaces can lead to exfoliation in some rocks although doubt is cast on this being purely the result of thermal fracturing. Evidence from beneath the thin peeled layers suggests that there has been chemical alteration, salt weathering and hydration seeming to be responsible. In other more heterogeneous rocks the heating and cooling effect on individual minerals leads to granular disintegration. Many will include freeze thaw processes which cannot be credited. Although night temperatures may drop below 0 °C there is insufficient water present and limited cycles to promote frost shattering of rocks. Chemical processes apart from salt weathering and hydration can include oxidation and even, though limited, carbonation and hydrolysis. Penetration of moisture into jointed limestone has been effective in some areas and leads to block disintegration on escarpments and wadi sides. Some may develop a distinction between the hot arid and semi-arid suggesting more active chemical weathering in the latter.

(b) Describe and evaluate the present day role of wind and of running water in the development of desert landforms. [15]

The best answers will be those in which both wind and running water are seen as working on, and modifying, some relic physical landscape developed over a long period with earlier much wetter climatic conditions. Many approaches though will no doubt be of detailing the processes of running water and wind with reference to appropriate landforms. In such cases the evaluation may well be the comparative effectiveness of the two processes and is acceptable, if done well, for Level 3. However the term 'present day' should signal a reference to the past. How effective present running water is could be a subject for debate; the role of stream and sheet floods have been seen as mainly transportation of materials both along wadis and across pediments although their role in developing pediments has been suggested as erosional. Alluvial fans and bahadas may well feature relevantly as streams issuing from wadis deposit their loads with a change of gradient etc. There have been graphic accounts of the effects of flash floods in wadis but the large accumulation of debris in valleys floors soon overload the running water. The role of wind may well be seen as being more effective with accounts of sand dunes, deflation hollows and the development of yardangs and zeugens and so on. Some may recognise the importance of the occurrence of the vast sand seas which feed the dunes and attribute them to earlier periods of active weathering and fluvial deposition. Similarly some may question the origin of yardangs and zeugens as purely the role of wind rather than wind removing the earlier weathered material in joints and weaker strata.

Level 3
Shows a very good understanding of present day fluvial and aeolian processes and a range of landforms to exemplify their role. Will evaluate their roles effectively by demonstrating a good knowledge of past climatic regimes. **[12–15]**

Level 2
Sound coverage of a range of landforms but with some limitations in detailing processes. Limited evaluation at the lower end of this level. **[7–11]**

Level 1
A collection of desert landforms to demonstrate the work of running water and wind but with little or no understanding. Evaluation absent or inappropriate. **[1–6]**

For no response or no creditable response, 0.

[Total: 25]