UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

9696 GEOGRAPHY

9696/22 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.

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UNIVERSITY of CAMBRIDGE
International Examinations

Tropical environments

Only **one** question may be answered from this topic.

1 (a) Describe and explain the differences between *humid* tropical and *seasonally humid* tropical climates. Support your answer with appropriate climatic data. [10]

Description should be straightforward but past experience suggests that explanation may be limited. Key points are that the humid tropics have all year rainfall (> 2000 mm) and uniformly high temperatures with low range (25 – 28 °C) whereas savanna has seasonal rainfall (750 – 1500 mm) and wider ranges of temperatures (> or < 24 – 34 °C). Appropriate references to humidity, winds and atmospheric pressures could add credit.

Explanations should be in terms of convergence at the equatorial zone and movement of the ITCZ. The degree of detail and accurate understanding will no doubt be wide ranging.
Nominally equal weighting but 6/4 or 4/6 could be appropriate.

(b) For one tropical ecosystem, explain the development and nature of the climax vegetation. Evaluate the success of any attempt to sustainably manage areas within one tropical ecosystem. [15]

Most will no doubt opt for the TRF. The nature of the climax vegetation will be well known by many but development will be more of a challenge (but it is in the syllabus). Some may well refer to Krakatoa and stages in development to a climax there. For nature, expect the great variety of vegetation types, structural layering, adaptations; drip tips, buttress roots et al. In savanna ecosystems, development to woodland, shrub and grass savanna will relate to the length of wet seasons but most savannas are a mosaic of communities controlled by grazing and fires. Parkland with acacias, baobabs, shrubs and species of grasses will feature as nature.

'Any attempt' (i.e. singular) should be a case study, which the syllabus demands, to illustrate the problems and attempted solutions in management. With a restriction to one, we should expect some detail of maintaining nutrient cycling even if reduced, preserving vegetation cover, controlling pure exploitation so as to maintain the areas sustainably.

Level 3
Some reference to development and a good understanding of the nature of climax vegetation with appropriate detail and terminology. A well presented and evaluated case study. [12–15]

Level 2
Adequate to good descriptions of the nature of the vegetation and some understanding of the problems of management if not so well evaluated. [7–11]

Level 1
Lists of vegetation types and/or weak knowledge of structure. Lack of reference to, or weak understanding of, climax vegetation. Exploitation instead of sustainable management and little or no evaluation. [0–6]

2 (a) With reference to one tropical soil type, describe and explain how climate, vegetation and soil forming processes lead to its typical profile characteristics. [10]

A diagram would seem essential here even though not specifically demanded. The syllabus lists oxisols/latosols, tropical red and brown earths but candidates may use other appropriate terms. The key is an appreciation of the role of climate in weathering and soil 'water' movement; promoting latosolisation or calcification (downward or upward movement of soil constituents) Also important is the contribution from vegetation; litter and humus. The profile characteristics should reflect the operation of the processes leading to the leaching of silica and laterisation with thick red/yellow horizons of Al and Fe sesquioxides in oxisols. In savanna areas, seasonally alternating upward and downward movements may lead to higher cemented layers and less well defined horizons.

(b) Photograph A is of a tropical karst (limestone) landscape.

With the help of Photograph A, describe the landforms of tropical karst landscapes. Explain the role of the climate, processes, rock type and structure in their development. [15]

Description should be straightforward and focus on the pinnacles and 'hollows' but with no doubt much reference to caves and even stalactites, etc. Credit reference to scale and any use of appropriate terminology. Explanation should be on the 'development' of the landforms, i.e. stages from some original surface with the role of a tropical humid climate accelerating chemical weathering, principally carbonation but also humic acids. The chemical composition of limestone and its jointed structure promote the initial surface hollows (opening of joints, dolines and later poljes etc). The landforms represent the remnants of such stages.

Level 3
Succinct and accurate description appreciating scale. Full understanding of processes and stages of development with appropriate terminology. [12–15]

Level 2
Basic description. Covers processes, climate and structure but with some lack of accurate detailing and/or use of appropriate terminology. [7–11]

Level 1
Weak description. Confused knowledge of processes and the nature of limestone; no references to stages of development. Focus on minor features. [0–6]

Coastal environments

Only **one** question may be answered from this topic.

3 (a) Explain how sea waves are generated. What factors determine the different nature of waves breaking at a shoreline? [10]

Past experience suggests that most will understand that wind generates sea waves and provide diagrams of oscillating water particles etc. The importance of fetch and duration will be added by the better ones. The second demand should relate to degree of shelving at the coast, to high and low energy types (destructive, constructive), plunging surging breakers. The effects of refraction and possibly reflection (clapotis – though not breaking) will be relevant. Many will not resist describing effects on beaches but that is not required.
Nominally equal weighting available but up to 6 for second demand.

(b) Explain the importance of the rock type, geological structure and marine and sub-aerial processes in developing landforms along a cliffed coastline. [15]

This should be an opportunity for them to display both detailed and accurate knowledge and understanding of the role of each of the listed inputs. Credit well the accurate use of examples with named rock types, the importance of jointing in some cases, faulting and other structures such as dip. Similarly, accuracy in the role of both marine and sub-aerial processes. There are many landforms associated with cliffs along with bays and headlands, along with more minor features such as stacks and arches. However, many answers will be limited in both coverage and depth. It should test good organisation of material. Thus expect headlands and bays but discordant and accordant with actual geology for top credit. Similarly with cliff profiles, the role of rock type and structure related to both cliff foot marine processes as well as sub-aerial processes – vertical, slumping and sliding and so on.

Level 3
Balanced coverage with accurate detailing of both geology and coastal geomorphology. Variety of selected landforms well exemplified and illustrated. High level of knowledge and understanding. [12–15]

Level 2
Less well balanced coverage with possible omissions of relevant content. Less precise in detailing processes and/or coverage of rock types and structures but sound to good knowledge and understanding. [7–11]

Level 1
Limited coverage, mainly arches stacks and stumps etc. Imprecise terminology, hard and soft rocks etc. Weak understanding of processes. [0–6]

4 (a) Study Photograph B which shows some landforms of coastal deposition.

Identify three features which have resulted from coastal deposition and give explanations for how those features have been formed. [10]

Spit, cuspate foreland, hook or recurve, salt marsh or just beach.

Explanations should involve long shore drift, (from two directions for cuspate foreland), prevailing and possible secondary wind directions, wave refraction, sedimentation/ flocculation for salt marsh development and so on.

Some aspects of explanation might apply to two or even all three features so equal division of marks inappropriate. Max. 7 though if only two selected or 4 if only one.

(b) Describe the characteristics of different types of coral reefs and explain their distribution. Assess the impact of past and present sea level changes on coral reefs. [15]

We should get, in sequence probably, fringing, barrier and atoll. Scale and form of reefs, i.e. fringing: building outwards with shallow lagoon, depth of outer reef limited by necessary conditions, etc. Barrier reefs well detached from island/coast e.g. Great Barrier Reef which will no doubt feature in many. Atolls: circular rings of coral islets, etc. They should, and probably will, be illustrated with appropriate diagrams. Distribution should be in terms of tropical seas with appropriate conditions for the growth of coral, mainly tropical western coasts of continents away from major estuaries and tropical volcanic islands in the Pacific and Indian oceans.

Sea level change could be both isostatic or eustatic and the latter range from major glacial changes to current rise in ocean temperatures. Some candidates may have attempted explanations in the first demand and already referred to such changes in connection with barrier reefs and atolls. A reduction in sea level will expose coral and lead to its dying, a rapid rise in sea level may prevent coral growth from keeping pace and die at deeper water depths. Reference to Darwin, Daly et al would be appropriate but not demanded. Some may exaggerate the present effects of sea temperature rise on sea level.

Level 3
Clear descriptions with understanding of scale and form of each of three types with good diagrams. Accurate details in explaining distribution. A realistic understanding of results of sea level change over time. [12–15]

Level 2
Coverage but some lack in fine detail or omissions. Distribution less well generalised (or patchy in coverage) than in L. 3 and more basic in knowledge and understanding of results of sea level change. [7–11]

Level 1
Lack of organisation in answers. Reefs may be covered at a reasonable level but distribution and results of sea level change receive minimal treatment. [0–6]

Hazardous environments

Only **one** question may be answered from this topic.

5 (a) Explain how different types of tectonic hazard may be generated at convergent (destructive) plate margins. [10]

Mainly expect earthquakes and volcanoes but reserve something for tsunamis. Secondary hazards such as lahars, landslides, liquefaction and so on are relevant but full marks can be gained without them as the question states 'generated at ...'

Balanced coverage together with accurate detailing and relevant diagrams needed for top credit as will decent exemplification.

(b) To what extent and why are earthquakes more hazardous events than volcanic eruptions? How may the hazardous impact of earthquakes be reduced? [15]

Largely they are because they cannot be predicted, either in place or time, and it is difficult to escape from unexpected collapsing buildings and so on; Haiti, etc. However there are many earthquakes which are not hazardous because of their low magnitude or location. The location of volcanoes is known and there are now well developed and reliable forecasts of eruptions. However, there may be some cataclysmic eruption which could have (and has had) massive consequences in terms of major destruction, loss of life and serious impact on climate.

Many will be keen to write mostly on reducing the impact of earthquakes. What we require is balanced coverage of prediction, building structures, hazard mapping, preparation/education.

Nominally equal weighting to each demand

Level 3
Balanced coverage of both demands. Both wide and deep knowledge and understanding. Well discussed 'to what extent' in first part with good detail and examples. Realistic appraisal of measures to reduce impact. [12–15]

Level 2
Less coverage and detail/assessment of first demand but some good examples and realistic understanding. Less balanced appraisal of measures to reduce impacts. [7–11]

Level 1
Lack of assessment and limited examples. Unbalanced and protracted accounts of measures losing focus on the impact of earthquakes per se. [0–6]

6 (a) **Fig. 1 shows some of the areas where tropical storms (cyclones and hurricanes) develop and the paths they take.**

Explain how tropical storms develop in the areas shown in Fig. 1 and why they take the paths indicated. [10]

The genesis of tropical storms will have been well rehearsed by most; it will be the degree of accurate and fine detail together with understanding that will differentiate the answers.

They develop over warm ocean areas (>26 °C) in a belt > 500 km N. and S. of the equator in late summer (when sea temperatures reach their maximum) and where the Coriolis force on converging air is needed to maintain the low pressure and deflect the winds. Undisturbed upper atmosphere allows the development of the massive uplift and generation of elements of the system – diagrams may add detail.

Movement westwards is promoted by out flowing air from high pressure systems (the Bermuda high in the case of Atlantic hurricanes) but accept a general movement from the trade winds westwards. However movement is highly complicated and is often erratic. Deflection polewards is affected by the blocking land masses and storms die out over cooler sea areas.

(b) **How and with what success can tropical storms be predicted and to what extent can their hazardous impacts be reduced? [15]**

From radar and satellite imaging, coupled with more basic weather observations in sea areas, tropical storms can be identified and tracked fairly accurately. Facilities more available to MEDCs than LEDCs. However predicting their tracks can be more problematic. Good answers will give examples and accurate detail, i.e. not just 'by computers', 'by aircraft', 'by satellites' etc.

The question demands consideration of the various hazards so not just the 'catch-all' lists which could apply to any and all hazardous events be they tectonic or atmospheric.

High rainfall leading to flooding and landslides – flood control measures along rivers, control of deforestation of slopes or building on slopes etc.

High winds – shelters, warnings, removal/securing of vulnerable structures etc.

Storm surges – sea walls, warnings to coastal crafts/moorings, evacuation of coastal areas, etc.

With what success? – again MEDCS v. LEDCs, but not only, and the use of examples.

Nominally 5/6 and 10/9 can be born in mind in apportioning credit to the two demands.

Level 3
Good knowledge of methods and limitations of prediction. Full and balanced coverage of hazards with relevant accurate detail backed up with apposite examples. Evaluation of success appropriate. [12–15]

Level 2
Some lack of fine detail on prediction. Coverage of the different hazards but less well balanced, mixed strengths and weaknesses in hazards. Evaluation limited. [7–11]

Level 1
General statements on prediction. 'Catchall' approach to hazard limitation and no valid evaluation. [0–6]

Arid and semi-arid environments

Only **one** question may be answered from this topic.

7 (a) Describe the characteristics of soils in arid and semi-arid environments and explain why they are difficult to manage. [10]

Soils often yield very weak responses but they are a principal element in the syllabus and should have received due attention. Credit well those that distinguish between arid and semi-arid. Both types are alkaline with salts being drawn upwards by capillary action. The grey colour of arid soils results from the lack of moisture which with the high pH restricts hydrolysis and the release of red coloured iron minerals and so on. Much detail could be added such as calcium rich, salt crusts and so on, but for many soils will simply be sandy, grey and salty. Soils are thin and lacking in horizons and structure; desert soils will be low in organic matter (< 1%). Collectively aridisols but types such as solonchaks and solonetz may appear.

In semi-arid areas the increased organic matter may be enough to colour the top soil to create chestnut-brown soils.

Soils are difficult to manage because of lack of structure and prone to wind erosion if disturbed. They can respond to irrigation initially but there are long term problems of salt accumulation. Again credit any who consider both arid and semi-arid. With the latter, cultivation of drought resistant crops may be possible as may managed grazing but again, both pose difficulties.

(b) Discuss the role of running water, both present and past, in the development of desert landforms. [15]

That running water has played a major role should be appreciated in erosion, transport and deposition; wadis/aroyas/canyons, mesas/buttes, alluvial fans/bahadas, pediments and playas. These can be detailed and the role of running water discussed.

There occurrence should be related to past pluvials but the present day episodic events are significant, e.g. in transporting sediments along wadis in raging torrents until it becomes choked and arrested. Intermittent streams feed playas.

Level 3
Accurate account of the development of a wide range of landforms. Good understanding of their scale and the role of running water in past pluvial periods as well as its present day role. [12–15]

Level 2
Coverage of a range of landforms, both erosional and depositional and sound to basic understanding of the role of running water. Knowledge of past pluvials but less of present day processes. [7–11]

Level 1
Limited coverage of appropriate landforms and imprecise detailing of their nature and/or the role of running water. Lack of understanding of the relative contribution of past and present. [0–6]

8 (a) **Fig. 2 gives information about part of the Sahara desert. The photograph shows a sand storm and rocky outcrops.**

Explain the role of wind in creating three distinct types of desert landform. [10]

Distinct landforms should exclude three types of dune. Most likely are a selection from deflation hollows, barchans, seifs, yardangs and zeugens or gours or mushroom rocks. Allow ventifacts/dreikanters for a maximum of two even though hardly landforms. Diagrams, well annotated, could suffice for full marks. Yardangs and zeugens need to be more than just the common cross section of 'hard and soft' rocks and barchans need accurate linking of morphology to wind direction and processes.
Mark nominally 4, 3, 3 but 4, 4, 2 allowable.

(b) **The information in Fig. 2 refers to human activities in the Sahara and the desert creeping south into the semi-arid Sahel.**

Explain possible causes of desertification and, with reference to an example, or examples, explain the problems of sustainable management in such areas. [15]

Natural and human factors should be addressed. Natural causes include climatic change, giving extended periods of drought or fire destroying vegetation. Destroyed or reduced vegetation cover in a dry environment leads to soil degradation and wind erosion. Human factors can be a major contributor: over grazing, depletion of any tree cover for building and fuel, inappropriate cultivation and irrigation and all exacerbated by increasing population pressure.

There are valid approaches in management to countering desertification; wind breaks or structures to restrict advancing dunes, banning deforestation (providing alternative fuel), avoiding overgrazing and planting drought resisting crops and controlled irrigation systems. However, lack of resources in such areas, both human (education and training) and capital. Good answers will be based on well developed and understood case studies.

Level 3
Balanced knowledge and good understanding of causes. Good knowledge of the physical environment with a realistic understanding of the difficulties of applying any sustainable management. Exemplification in all parts of the answer. [12–15]

Level 2
Both parts of the question addressed but somewhat lacking in accurate detail and limited in examples. Some appropriate management but with limited understanding of problems. At the lower end of the level the management strategies are unrealistic and an awareness of the true nature of the environment lacking. [7–11]

Level 1
Weak in coverage and appropriate accurate knowledge. Limited causes and lack of detail of management or unrealistic programmes. [0–6]