

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2007 question paper

9696 GEOGRAPHY

9696/02

Paper 2 (Physical Geography), 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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Physical geography options

Tropical environments

- 1 (a) Describe the process of laterisation and explain its influence upon soils in the tropics. [10]**

Laterisation is a process ongoing principally in the seasonally humid tropics, although latosols are found more widely throughout the tropics. The process occurs where the weathered layer is leached of bases and soluble silica whilst the relatively insoluble oxidised iron and alumina accumulate. Wetting and drying can lead to a crystallisation of the iron forming a duricrust several metres thick or in the case of soils, the leaching of base elements produces a hard ferrallitic zone. This can be effectively demonstrated by illustrations of soil profiles.

- (b) In developing policies for the sustainable management of one tropical ecosystem, explain which characteristics of the physical environment need most consideration. [15]**

The emphasis here is on the physical attributes of the chosen ecosystem that form the most important parameters in framing any plans for sustainable management. Thus in the tropical rainforest (the most popular choice) it is the nutrient flows and the productivity of the biomass store that make it vulnerable to change and therefore sustainable management. This can be illustrated through case studies of particular attempts to manage development of the ecosystem such as small-scale cultivation, silviculture, ranching etc. The seasonally humid tropics pose different problems in terms of seasonally moisture deficits, lateritic soils and dangers of over exploitation.

L3: Concentration will be upon the physical attributes of the ecosystem and their defining role in sustainability. Examples of particular activities will be employed to illustrate this. **[12–15]**

L2: More attention will be paid to the human activities in the context of management although there will be some development of the physical aspects of the ecosystem that act as limitations for sustainability. **[7–11]**

L1: Human activities in terms of clearance, cultivation etc with only passing reference to the nature of the ecosystem or to concepts of sustainable management. **[0–6]**

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2 (a) Fig. 1 shows the formation of an etchplain.

Describe the processes that produce such an etchplain and briefly describe the landforms produced. [10]

The diagram clearly shows the removal (stripping) of regoliths to expose a basal surface of weathering. The stripping occurs over several episodes and is conducted by lateral planation by rivers or a combination of stream and sheet wash transportation. Weathering processes are concentrated along joints but it is not necessary for candidates to spend time on developing the basal surface of weathering in the context of the formation of landforms, as only a description of them is required. Hence the smooth domed surface of the gently rounded ruware, the blocky outcrops of koppies and the large rock domes with steep sides and rounded summit profile of the bornhardts.

(b) Explain how climate has influenced the development of vegetation and soils in either the humid or the seasonally humid tropics. [15]

The climates of the humid or seasonally humid tropics should be given in terms of precipitation, temperatures, humidity, seasonality etc. This should then be associated with both the development of vegetation structures of either the tropical rainforest or the savanna. Soils can be developed in a similar manner with the emphasis on leaching and/or seasonal soil moisture deficits. It is possible to demonstrate many vegetation adaptations to climate in both ecosystems although, candidates' association of climate and soils may prove more limited.

L3: Good coverage of basic climatic details and link not only to general vegetational structures but to some examples of the many adaptations. Soils will be covered but in a more generalised manner. [12–15]

L2: Climatic parameters will be established although the links with vegetation will be less well developed. Soils will appear more as an afterthought. [7–11]

L1: Climatic details will be outlined (hot/wet etc) and the link with vegetation will thus be a general one i.e. diversity and abundance as against restricted growth of grasses and water storing trees. Soils will be largely ignored. [0–6]

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Coastal environments

3 (a) Explain the conditions that are required for the formation of coral reefs. [10]

As a marine organism coral requires: temperatures generally above 20C with optimum 25–30 C; sufficient light (depth) for photosynthesis to occur; salinity within range 27–40 (i.e. not extreme). Suitable surface to develop upon (firm base); limited amount of turbulence for oxygen and nutrient supply; lack of sediment (clear water); not too great a tidal range or large changes in sea level; gentle currents; food supply (zooplankton).

The different types of reef may be developed and can be relevant as long as they are linked to explaining the conditions.

(b) Describe the sources, transportation and deposition of coastal sediments. Illustrate your answer by reference to examples of the coastal landforms that are produced by these processes. [15]

The sources of marine sediments are from the processes of coastal erosion and the supply of material from rivers etc. via estuaries. The processes of transportation occur due to wave action, tides and currents. Candidates should be able to develop longshore drift in this context. Deposition occurs when there is a loss in the competence of the drift due to a change in coastal shape, the ingress of a river or because of the shallowing of the coast. Deposition can be demonstrated in terms of the landforms such as beaches, spits, bars etc. A universal coverage is not required. Sufficient to illustrate the processes is acceptable.

L3: A well structured account that deals effectively with the processes and illustrates them with appropriate landforms. Could adopt a systems approach. **[12–15]**

L2: Less well organised but an understanding of the basic processes such as LSD and deposition. The landforms will be less well related to the processes and may appear as separate features of the answer. **[7–11]**

L1: Poorly organised account with only vague and partial coverage of processes which are not linked to the landforms. **[0–6]**

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4 (a) Photograph A shows landforms developed in a high energy coastal environment.

Draw a labelled diagram to show the main features of the coastal landforms and describe what influences their formation. [10]

The diagrams should demonstrate the main features of the cliffed coastline with its prominent jointing. This has led to a block disintegration under impact from both marine and sub-aerial erosion and weathering. Good candidates may show strata, dip etc. The nature of the rock type and structure are clearly vital elements in the development of the landform and a strong hint is given in the description of the coast as a high energy environment which should be explained.

(b) To what extent have human activities affected natural processes in the management of coastal areas you have studied? [15]

This is an opportunity for candidates to develop a case study in the context of the human activities interfering with the marine processes. In most cases this will be seen as an attempt to control coastal erosion through the impact of various types of hard and soft engineering. The destruction of coral reefs could be viewed in the same manner as optimum conditions for their survival may be endangered by various human activities.

L3: A well-developed case study (or examples) of management strategies and their impact upon the ongoing physical processes. Some assessment will be made of the extent to which the actions have affected or been affected by physical processes. **[12–15]**

L2: The emphasis will be on the coastal schemes rather than their interaction with process. Hard and soft engineering examples will be employed with some sort of assessment in terms of success and knock-on effects. **[7–11]**

L1: Rather random exemplification of coastal protection methodologies with a token attempt to assess success but with little recognition of physical processes. **[0–6]**

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Hazardous environments

5 (a) Under what circumstances are volcanic eruptions hazardous? [10]

Principally when they erupt in the proximity of human settlements. Some are more hazardous than others, however. Particularly those of Plinian eruptions where high speed pyroclastic flows can quickly overwhelm large numbers of people e.g. Bay of Naples. Other erupted materials have different levels of hazard risk. Ash, tephra and types of lava flows can be assessed. Secondary effects of lahars and landslides as well as blast effects (Mt St Helens) Global impact from ash in the stratosphere can also be assessed.

(b) Explain which areas are most at risk from hurricanes. Describe the main hazards that are produced by the passage of a hurricane/tropical storm. [15]

Hurricanes occur between 5°–30° latitude where sea surface temperatures are greater than 26°C. They require sufficient spin from the Coriolis force, which limits their development outside the tropics. They tend to move westwards and slightly towards the poles. As they move polewards they pick up speed. Vulnerable areas are those with low-lying coasts or funnel shaped coastlines. Thus the Gulf of Mexico, Bangladesh etc. which are low-lying shelving coastlines with large populations are very vulnerable. As huge heat engines, hurricanes generate very high wind speeds which can cause considerable structural damage in the immediate coastal littoral. These wind speeds decline fairly rapidly as the system loses power overland. More lasting damage is inflicted by flooding consequent upon the intense rainfall and the storm surges as seen in Hurricane Katrina and Rita. These can, in turn, lead to landslides and health problems.

L3: Good understanding of the conditions and location of hurricanes and the explanation of their hazardous nature will be expressed in terms of examples. [12–15]

L2: Some understanding of the nature of the formation of hurricanes and hence at risk areas. Most of the answer will concern hazardous effects, which will only partially be related to the nature of the events. [7–11]

L1: Accounts of the impact of hurricanes largely expressed in lurid accounts of high winds and flying debris etc. Little explanation of location or of events. [0–6]

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- 6 (a) **Table 1 shows the causes of and deaths from some major landslides. With the help of Table 1, explain how landslides occur and may become hazardous. [10]**

Landslides are the product of sudden slope failure causing rapid movements of masses of rock and regolith. These are clearly hazardous where they occur in the locale of settlements which are placed on or below vulnerable slopes. The triggers for such mass movements are quite different and can cause vulnerability on different types of slopes. Candidates should be able to extract from the table examples of seismic initiation which is most common and causes greatest fatalities as well as those consequent upon hurricanes (intense rainfall) and volcanoes, which could be a mixture of seismic and rainfall effects. Good answers will be aware of shear strength of rocks as well as the movements of saturated regolith over a less permeable strata.

- (b) **Using an example (or examples), explain the extent to which it is possible to manage the human occupation of a hazardous environment. [15]**

Many very (often multi-) hazardous environments are densely populated e.g. California, Japan, surrounds of volcanoes etc. Here the task of attempting to manage the hazard risk is at a premium but much will depend upon the relative level of wealth and investment (MEDCs as against LEDCs) Prediction is clearly a major element and methodologies and their level of success discussed in the context of particular environments. Planning for a hazardous event can be illustrated through the relative levels of land use and building planning and control in relation to estimates of likely hazard occurrence (preparation of maps of hazard potential risk) Education can be a vital element. Even so, the ability to influence or to minimise the effects of major events may well be limited, as evidenced by Japan.

L3: Good use of a case study or of examples that illustrate the problems of human occupation of such areas with a realistic assessment of sustainability. **[12–15]**

L2: Emphasis will be on preventative or ameliorating measures (sprung buildings etc.) although there will be some awareness of the problems of hazards and large populations. **[7–11]**

L1: Seen as an opportunity to relate the disastrous consequences of hazardous events with little mention of any management attempts. **[0–6]**

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Arid and semi-arid environments

- 7 (a) Describe and explain the climates that are characteristic of deserts and semi-arid areas. [10]**

Desert (arid) climates are those with a marked water deficit where the annual loss of water through evapotranspiration is greater than the gain through precipitation. Precipitation is generally less than 250mm. Daytime temperatures are high but can fall below freezing at night. Rainfall is episodic and generally convective. A windy environment characterised by dust storms. Semi-arid areas have low and irregular patterns of precipitation that are seasonal, with long dry seasons. Sometimes rainfall can be relatively high but is poorly distributed and subject to rapid loss through high rates of run off or evapotranspiration. High seasonal temperatures and limited vegetation give rise to low humidity levels. Explanations can be given in terms of sub-tropical highs, rain shadow, ocean currents and seasonal movements of ITCZ.

- (b) Describe the nature of climatic change that has occurred in arid areas since the Pleistocene. What impact has climatic change had upon desert landforms? [15]**

The Pleistocene was characterised by the movement equator-wards of wetter, cooler conditions giving current desert areas more temperate and humid conditions. Thus major depressions and extensive plains could have been formed by fluvial erosion (peneplanation) and rivers could have eroded flat areas between present day mesa and buttes (e.g. Arizona). Fluvial deposition can explain the existence of sand seas and the processes of fluvial erosion and stream and surface wash account for inselbergs (pedeplanation), mountain fronts, deeply dissected upland areas, wadis and the like.

L3: Good outline of past pluvials and subsequent increases in aridity. An appreciation of the larger scale impact of wetter climates upon the larger environmental processes (e.g. weathering, availability of sand, pediplanation etc.) as well as erosive impact on individual landforms. Low rates of current processes have led to the dominance of relict features. **[12–15]**

L2: More concentration upon the effect of past pluvial activity on individual landforms or groupings of landforms (e.g. the desert piedmont). A tendency to catalogue landform features in terms of evidence for water erosion rather than the impact of process on landform. **[7–11]**

L1: An awareness of a wetter past but little detail. A rather unstructured range of landforms with little explanation as to how they have been affected by a wetter climate. **[0–6]**

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- 8 (a) Fig. 2 shows the nutrient cycles of desert and semi-arid areas. Describe the similarities and differences of the two nutrient cycles and explain the impact such nutrient cycles have upon the productivity of the biomasses. [10]

Similarities exist in the limited nature of nutrient cycling with low levels of precipitation input and surface runoff. General flow levels are larger in semi arid and candidates should be able to point to the differences in store sizes. In semi-arid the biomass provides the biggest nutrient store whilst in arid areas it is provided by the soil. The reason for the higher level of productivity due to seasonal water supply, the release of nutrients through fire to circulate rapidly through the system. In arid areas litter is slow to decompose, although leaching is minimal. Transfer to the biomass is limited due to the lack of water. Loss from the biomass is high due to the loss of plant material in periods of drought.

- (b) Describe the main processes of transportation and deposition in desert areas. Illustrate your answer by reference to desert landforms. [15]

Transportational methods should include both wind and water. Hence suspension, saltation and traction should be matched by the entrainment of sediment during sheet and stream floods. Deposition can similarly be described as a loss of competence of both wind and water. This can be amply illustrated by dunes in the case of wind and by alluvial features of the desert piedmont and alluvial deposits in wadis etc.

L3: An appreciation that there are similar processes at work in both the case of wind and water, although candidates may choose to deal with them separately. Useful illustration of the processes by selection of appropriate landforms demonstrating some balance between wind and water. [12–15]

L2: Seen mainly as a wind process with coverage of everything from deflation hollows through to barchans etc. Water should make some appearance for better marks, although it may serve as an afterthought. [7–11]

L1: Seen solely as an opportunity to deal with the role of wind in deserts and may well include features of erosion (yardangs etc.) as part of the landforms. No mention made of the role of water. [0–6]