

## **MARK SCHEME for the October/November 2006 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 students, 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.

The grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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<b>Page 2</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

## **Tropical Environments**

- 1 (a) Illustrating your answer with a diagram, explain the characteristics of one soil found in the humid or in the seasonally humid tropics. (10)**

Candidates will probably select oxisols (latosols) or vertisols. Soils where rainfall is high and climate hot are often intensely weathered and infertile as their nutrients are leached away. This can leave a residue rich in iron i.e. laterite which can sometimes dry out to produce a lateritic crust. Vertisols are more common in the seasonally humid tropics. These are often found at the base of a catena and have a high clay content. The alternate wet and dry seasons can lead to swelling and shrinking producing cracking.

- (b) Describe the vegetation structures that characterise the tropical rainforest and the savanna. Explain why the vegetation structures are different. (15)**

Tropical rainforests can be described as closed canopy forests with three (sometimes four) vegetation strata. The upper stratum reaches a height of 30 – 60 m with trees that emerge from the canopy up to 80 m. They have a large proportion of broad leaved evergreen trees and an abundance of thick woody climbers (lianas) and epiphytes. Leaves are leathery and characterised by drip tips. The trees have buttress and aerial roots. Shrub and herb layers are poorly developed with ferns forming a high proportion of the vegetation. Savannas today are largely dominated by grass species (graminoids), together with some herbaceous non-grass species. They have a light to dense scattering of trees (acacia and baobab) which exhibit xerophytic tendencies. The differences are largely due to climatic differences and the impact of the dry season in the savanna. Additional impact has been provided by the destruction of woodland in the savanna by fire which has encouraged grass growth.

### **Level 3**

Reasonable descriptions of both TRF and savanna vegetation with some concept of structures. Differences will be assigned to the climatic contrasts.  
A balanced account.  
(12-15)

### **Level 2**

A more generalised account of vegetation with probably less balance between the two. Some awareness of structure although it may not be prominent in the accounts.  
Aware of climatic influences.  
(7-11)

### **Level 1**

Basic description of vegetation that does not go too far beyond trees in one and grasses in the other. Lack of balance and differences may be assigned to climate for TRF and fire for savanna.  
(0-6)

<b>Page 3</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

**2 Photograph A shows a landform that is the result of the weathering of granite in a tropical environment.**

**(a) Describe the landform shown and explain the weathering processes that may have produced it.**

**(10)**

Photograph A shows spheroidal weathering. The description should refer to the rounded nature of the product as well as the angular nature of some smaller detritus. Many will assign this to exfoliation. They will suggest that it is caused by differential expansion due to heat and possibly reflecting the different mineral properties of granite. More astute answers will perceive a chemical weathering component. This will allow the development of structures like core stones, often at depth, that have been produced from jointing patterns having an original cuboid structure.

**(b) Why is the management of the tropical rainforest ecosystem so difficult?**

**(15)**

The management has proved difficult because of the nature of the ecosystem. With so much of the nutrient store in the biomass it means that any action or management that alters or destroys the biomass can result in the destabilisation of the ecosystem. As management implies some use by humankind of the ecosystem, no action is not a possibility. Clearly some activities are easier to manage than others. Thus low level shifting cultivation or selected felling allow recovery and a general maintenance of the system. Clear felling, large scale cultivation and grazing deplete the nutrient stores, and can be characterised by diminishing returns, loss of biodiversity and global implications for climate.

**Level 3**

An attempt to produce an argument based upon the nutrient cycle of the TRF ecosystem and the likely impact of different management activities.  
(12-15)

**Level 2**

These accounts will concentrate more upon human activities within the TRF, but will display an awareness of the consequences. There will be some understanding of the impact upon soils, animals, vegetation even if not directly expressed in terms of nutrient cycles.  
(7-11)

**Level 1**

Seen as an opportunity to write about clearance of TRF with little indication of either consequences or of management.  
(0-6)

<b>Page 4</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

## Coastal Environments

- 3 (a) Describe the characteristics of constructive and destructive waves. Explain how they can affect the form of beaches. (10)**

Constructive and destructive waves should be described in terms of frequency, swash and backwash and plunging breakers. These could be shown diagrammatically. The effect on beaches is more constructive in terms of swash domination – sediment moving up the beach and its removal when it is combed down. This can produce distinctive profiles leading to the production of berms etc. Again diagrams could be effectively employed.

- (b) Explain the main factors that can affect the form of cliff profiles. (15)**

The factors that can affect sea cliff profiles are wave action (dependent upon fetch etc.), marine erosion processes, geology and sub-aerial weathering and erosion. These combinations can be shown to produce distinctive profiles and answers should demonstrate some of these and not merely generalise the cliff forms ('any cliff'). Clearly there is a lot of material available so we will expect some selectivity. Even so there should be some representation in each of the factor areas as well as some idea of impact.

### Level 3

Good grasp of processes and aware of the impact of high energy environments. Some comprehension of the importance of the varying impact of process and geology to produce different profiles.  
(12-15)

### Level 2

Erosional processes will be well described although the impact of geology will be less well developed. There will be some contrast in differing profiles although these may be limited in scope.  
(7-11)

### Level 1

Partial coverage of erosional processes but geology limited to hard/soft etc. Little idea of the variation in profiles or how they are produced.  
(0-6)

<b>Page 5</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

**4 Fig. 1 shows some features of the Great Barrier Reef in Australia.**

- (a) Describe the main features of the reef and the physical conditions necessary for such reefs to exist.**

**(10)**

The Great Barrier Reef is the greatest coral formation in the world at about 2000 km in length. It is the most continuous in the north with chains of coral up to 25 kms in length. There are some breaks (e.g. Grafton and Flora passages). It is developed in shallow water up to 50 m depth (i.e. landward of the continental shelf) in clear waters with average temperatures above 20°C. The waters should be pollution-free allowing the coral to grow upward from shallow platforms.

- (b) Why are some coastal areas considered to be fragile environments? Suggest ways in which these environments can be protected.**

**(15)**

Some coastal areas are more vulnerable due to the interaction of wave processes and geology which can bring about coastal retreat. The existence of high energy environment does not always produce vulnerability (e.g. granite coasts of Cornwall) On the other hand lower energy environments can produce vulnerability when allied with less durable geological materials. Similarly many depositional features (spits, salt marshes, bars etc.) represent a fine balance between erosion, transport and deposition. This balance can be easily disturbed by human interference with sediment supply or through natural events such as storms. Protection can be afforded by hard engineering, beach replenishment etc. or through a process of less intervention.

**Level 3**

Good understanding of the balance between processes and geology. Probably will employ apposite examples and develop these in terms of coastal protection.  
(12-15)

**Level 2**

More exemplar or case study based. This will be employed to suggest vulnerability but often without too much indication of the geology. Hard engineering will be the chosen solution.  
(7-11)

**Level 1**

Simplistic case study/example with only vague reference to processes and virtually none to geology. Concentration will be on hard engineering (e.g. groynes etc)  
(0-6)

<b>Page 6</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

## Hazardous environments

### 5 (a) Where and why are hurricanes (tropical storms) a major hazard? (10)

Hurricanes are most frequent 10-15 degrees either side of the equator. They are generated from pre-existing disturbances in areas where the sea surface temperatures are above c. 27 °C. As they generally travel from east to west they become hazards wherever they are likely to encounter densely settled areas. Thus the track from the mid Atlantic to the Caribbean and the Gulf of Mexico makes them potentially hazardous due to the high wind speeds and more importantly the torrential rainfall that can cause massive flooding and landslips. Other areas such as the Bay of Bengal are also very vulnerable due to the low-lying delta areas that are heavily populated and extremely vulnerable to flooding.

### (b) To what extent is it possible to predict the development and path of a hurricane (tropical storm)? What action can be taken to reduce damage and loss of life from hurricanes (tropical storms)? (15)

The circumstance under which hurricanes are formed is well known as are the times of the year when they are likely to develop in certain areas. Monitoring of atmospheric disturbances in such areas is possible but in the past was often hampered by the lack of recording stations. Now satellites enable the monitoring of such things as well as charting the progress of hurricanes once formed. Upper air data is also more readily available giving some indications of the likely strength of the system. All such monitoring, interpretation and prediction are expensive and hence are more available and efficient in the developed world (e.g. Florida, Australia, Japan) than they are in the developing world (e.g. Bangladesh). Similarly, the response in terms of ameliorative action will be dependent on wealth and infrastructure. Hence evacuation can be more effectively applied in Florida than it could in Bangladesh. Hurricane shelters can be constructed and screens and stabilising ties used to protect buildings against wind. Drainage systems can be constructed to cope with flooding. These are rarely available in poor communities where the risk of catastrophic flooding has been exacerbated by forest clearance.

#### Level 3

An awareness of the methodology of forecasting and tracking of hurricanes and its limitations in terms of hazard prediction. A range of ameliorative responses and an understanding of the impact of poverty.

(12-15)

#### Level 2

Some awareness of forecasting and tracking of hurricanes although not necessarily of their limitations. Mainly an account of responses often based upon examples or an example of an event.

(7-11)

#### Level 1

Probably will be an account of the incidence of a particular hurricane and the damage it produced.

(0-6)

<b>Page 7</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

**6 Fig. 2 shows the global distribution of earthquake epicentres.**

**(a) Describe and explain the distribution of earthquake epicentres shown on Fig. 2.**

**(10)**

Earthquakes generally follow a similar global pattern to that of active volcanoes, thus they reflect plate margins. The Pacific Ring of Fire is equally represented in terms of earthquake epicentres (i.e. the margins of the Pacific plate). Some areas within this however, show greater densities of earthquake activity such as the Philippines and in the north Pacific (Aleutian Isles). The mid Atlantic ridge is also identifiable. The connection with plate margins should be noted and some limited explanation given. The existence of movement along fault planes can also be demonstrated and areas of recent mountain building.

**(b) Explain how earthquakes occur and suggest ways in which their effects can be minimised.**

**(15)**

Earthquakes are a series of shocks due to a sudden movement of crustal rocks. This mainly occurs along faults where energy from movement has become stored allowing the development of a major movement (elastic rebound). This can lead to earthquake storms along faults (e.g. California or Anatolian faults). Energy is transmitted from the focus to other parts of the earth through seismic waves (P and S waves). Ground motion results from seismic waves leading to building collapse disruption of roads and services and regolith slips and slides. The best way of minimising impact is to predict occurrence and hence allow time for evacuation. This is still limited in accuracy of timing. Building techniques can be adapted as can the construction and location of services in earthquake prone zones. Education of the public as to response can also be efficacious in saving life.

**Level 3**

Some understanding of the cause and occurrence of earthquakes rather than just its manifestations. Similarly an appreciation of the relative abilities to respond depending upon resources. Good use of examples.

(12-15)

**Level 2**

The account will concentrate more upon response rather than causes. However there should be some appreciation of earthquakes per se and not just effects. Examples of response will be cited at length, probably from Japan and USA.

(7-11)

**Level 1**

Used as an opportunity to describe an earthquake and its destructive effects.

(0-6)

<b>Page 8</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

### **Arid and Semi-arid environments**

- 7 (a) Describe and explain the operation and effects of wind erosion in hot arid environments. (10)**

Wind erosion is the product of sand storms which have a powerful blasting effect. This can be concentrated where the wind is funnelled along depressions etched from joints or faults. Generally most erosive activity is concentrated up to 0.5 m above the surface. Mainly polishes hard rocks and undercuts weaker ones. The effects can be illustrated by yardangs and zeugens as well as deflation hollows.

- (b) Describe the processes of weathering in hot arid environments. Explain which processes are most effective in bringing about block and granular disintegration in these environments. (15)**

The high temperature range will be assumed to produce thermal fracturing on a wide scale. Salt weathering and hydration may also be described. Chemical weathering, although inhibited by arid conditions, is present and has clearly been important in the past. Thus chemical weathering (e.g. hydrolysis, oxidation etc) can be described. The abundant talus deposits on the margins of limestone wadis are likely to have resulted from the collapse of jointed rocks after selected chemical attack along joint lines and bedding planes. Rounded boulders in granite areas and the existence of weathering caverns also attest to the influence of chemical weathering rather than thermal fracture, as do the existence of numerous platy fragments littering rock surfaces.

#### **Level 3**

An appreciation of weathering forms that encompasses both thermal fracture and chemical weathering. Some ability to relate the weathering processes to the weathered product, even if somewhat limited in the appreciation of the impact of chemical weathering.

(12-15)

#### **Level 2**

Accounts will concentrate more upon thermal fracture and its effects in terms of producing weathered material. There will be some awareness that chemical weathering has a role in these circumstances (Blackwelder and Griggs etc) although its full impact in terms of disintegration may be sketchy. May assume that expansion of mineral elements leads to granular disintegration, whilst surface flaking is block disintegration.

(7-11)

#### **Level 1**

Little beyond thermal fracture and an assumption that it produces all forms of detritus in desert environments.

(0-6)



<b>Page 9</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>GCE A/AS LEVEL - OCT/NOV 2006</b>	<b>9696</b>	<b>2</b>

**8 Fig. 3 shows two types of vegetation found in hot arid environments.**

**(a) Describe the vegetation types shown in Fig. 3 and explain how each has adapted to aridity.**

**(10)**

The two types:

A are phreatophytes, which have developed long tap roots to penetrate into or near to the water table. Examples would be date palm, tamarisk and mesquite. They are more common on stream margins or near channels and springs where the water table is nearer to the surface.

B are xerophytes, where plants have adapted to resist drought and to some extent salinity. Transpiration is reduced by means of dense hairs covering waxy leaf surfaces, the closure of stomata. Others impound water in leaves, roots and stems (e.g. succulents like cacti, prickly pear and euphorbias). They also exhibit large root networks.

**(b) To what extent has it been possible for humans to adapt arid and semi-arid environments in order to make them productive?**

**(15)**

Various attempts have been made to introduce water into desert areas to provide either agriculture or resource exploitation. This has varied from damming rivers (e.g. Aswan) to provide irrigation water, desalination plants and the various water harvesting schemes. The success of agriculture has been limited due to salinisation and high cost. Drip feed irrigation can mitigate salinisation and has been successfully employed in deserts such as the Negev. Exploitation of resources such as oil has been more successful due to the high levels of returns and the ability to ship in the requirements of the work force. Again desalination of sea water and the piping of supplies has been widely employed. The most common exploitation remains nomadic herding relying on low densities of occupation and naturally occurring water supplies.

An opportunity for case studies or examples.

### **Level 3**

Good use of case study or of examples that do attempt some degree of evaluation i.e. the extent to which it is possible to adapt such harsh environments.

(12-15)

### **Level 2**

Mostly accounts of examples of efforts to make the desert bloom through irrigation etc. There may not be much awareness of mineral resource exploitation, although there will be some limited attempt at evaluation.

(7-11)

### **Level 1**

Vague references to irrigation schemes with little indication as to their techniques or practicalities. No evaluation

(0-6)