

## MARK SCHEME for the November 2005 question paper

### 9696 GEOGRAPHY

9696/02

Paper 2 (Physical), maximum raw mark 50

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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 minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

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Answer **two** questions, each from a different environment.

### **Tropical Environments**

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

- 1 (a) Describe what is meant by *convectonal heating*. Explain how convectonal heating can affect tropical climates.** [10]

Convectonal heating is produced by the heating of the surface through isolation and the transference of the heat through LWR to the atmosphere in contact with the surface. This leads to thermal uplift particularly in areas such as the tropics where there is high levels of insolation. The rising and cooling of air adiabatically will bring about ppt. Such ppt associated with direct surface heating and movement of the ITCZ brings about most ppt in the tropics. Distinction could be made between seasonally humid and humid tropics (seasonal as against diurnal convection).

- (b) Describe the natural vegetational structure of the tropical rainforest. How have human activities affected the structure and type of vegetation in parts of the tropical rainforest?** [15]

#### **Level 3**

The natural vegetational structure comprises an upper tree layer (>25 m), a middle tree layer (10 – 25 m), a lower tree layer (5 – 10 m), a shrub layer, and a herb layer. Diagram could be used to show this.

The vegetation is nearly all evergreen, most have leathery dark green leaves with drip tips many have buttress roots, the trunks often bear fruits, climbers (lianas) abound, a large number of epiphytes. Shrub layer poorly developed. Tall trees and great diversity of species.

Human activities have cleared much of the trees, increasing light and hence producing secondary forest. Soil deterioration tends to inhibit return to climax vegetation. [12 – 15]

#### **Level 2**

Structure understood in general terms but lacking detail. Vegetation concentrates on tall trees and diversity with little relationship to structure. Human activities likely to dominate the answer and will largely be concerned with clearance for grazing cultivation etc. rather than emphasising changes to the vegetation itself. [7 – 11]

#### **Level 1**

Structure may well be omitted in favour of a vague description of rain forest vegetation. At least some awareness of layering should be evident for a pass.

Most of the answer will launch into TRF destruction with little emphasis on vegetation. [0 – 6]

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- 2 (a) Fig. 1 shows some landforms found in limestone (karst) regions of the Tropics. Identify and explain the processes that have produced these landforms.** [10]

The process of carbonation should be described and (for good marks) an awareness shown of the vulnerability of limestone both chemically and structurally. The individual landforms should be explained in terms of rapid chemical reactions and abundant water supply leading to tower karst etc. in the Tropics. The incision of drainage and the survival of more massive areas of towers might be recorded by the best answers. Others will concentrate on sinkholes and collapsed caverns etc.

- (b) Describe the climate, vegetation, soils and nutrient flows of the tropical savanna ecosystem. How have human activities contributed to the development of this ecosystem?** [15]

**Level 3**

The Savannas are seasonally dry varying from 2.5 to 7.5 in duration. This is due largely to movements of the ICTZ and many areas are prone to drought. The vegetation consists of grassland and scattered trees. The trees are 6 – 12 m in height, strongly rooted with flattened crowns. They exhibit drought and fire resistant features (e.g. seasonal leaf loss and water storage – baobab). Grasses are long (up to 3.5 m) and produce dry season fires. Soils often have lateritic hardpans and are poorly drained. They often exhibit low water retention in the dry season. Nutrient flows may most readily be shown by the usual gerschemel diagram. Fire is an important factor in development and African herdsmen and agriculturalists use fire to encourage perennial grasslands with underground stems. [12 – 15]

**Level 2**

Seasonality will feature in climatic conditions as will drought although the association with ICTZ will be absent or vague. Vegetation will be seen as baobabs and grassland and will be viewed as a product of deliberate fire setting. Soils should be mentioned for a pass but will be little more than lateritic. [7 – 11]

**Level 1**

Seasonal drought and grasslands will be the main description. Some awareness of the role of fire but none of soils. [0 – 6]

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## Coastal Environments

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

- 3 (a) Identify and explain the factors that can influence the development of cliff profiles.** [10]

A cliff profile is produced by a balance between the rate of erosion at the base and the rate of recession through weathering, mass movement. Thus there will be variations due to marine action (high/low energy) climate and rock type and structure. Better answers will give examples of different profiles produced.

- (b) Using diagrams, explain the formation of :-**

- (i) offshore bars,**
- (ii) barrier beaches,**
- (iii) coastal dunes.**

**To what extent can these coastal landforms be protected?** [15]

### Level 3

The sediment for these landforms is generally supplied through LSD. When material is dropped parallel to the dominant waves an offshore bar forms. These are submerged at high tide and are found on shallow coasts with gentle gradients. Waves break offshore eroding the sea bed. Where bars are developed across the mouths of bays and inlets they can form a barrier beach. Dunes are found on landward edges of extensive beaches and on spits and bars. They are formed by onshore winds and stabilised by grasses. Most can be achieved by good diagrams.

Generally these are fragile environments and efforts can be made to protect sediment supplies and in the case of dunes prevent trampling. Offshore bars have a tendency to migrate inland and little can be done to prevent it. Beaches can be preserved by nourishment. [12 – 15]

### Level 2

Diagrams will show basic shapes but will be less well developed in terms of any explanations as to formation. Even so there will be an acknowledgment of the coastal movement and deposition of sediment. Coastal protection may well be seen in terms of hard engineering such as groynes etc. rather than sediment supplies. [7 – 11]

### Level 1

Uneven diagrams with some being very vague (probably barrier beaches). May well concentrate attention on one form (e.g. dunes). Protection will often be unrelated to feature and vaguely refer to hard engineering and groynes etc. [0 – 6]

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- 4 (a) Describe the development of sea waves and explain how they transport sediment. What are the main sources of the sediment carried by waves? [10]**

Waves are orbital movements of water powered by the wind. They are thus dependent upon wind strength, fetch, depth etc. Waves can be seen as constructive or destructive and have a plunge lines, swash and backwash. Sediment is carried in suspension or can be rolled. Most sediment is transported by LSD. The material can be obtained from coastal erosion of cliffs etc., obtained from sea floor or from river estuaries. Beaches themselves also supply sediment from destructive waves and rip currents.

- (b) Fig. 2 shows some landforms of a cliffed coastline. Describe the landforms named on Fig. 2 and give an explanation of their formation. [15]**

**Level 3**

The coastline shown is one produced by cliff retreat through the activities of marine erosion. Simple descriptions of cliffs, wave cut notch stack, stump arch, cave and wave cut platform. It is the explanations of the features in terms of the marine processes involved and the lithology of the coastline that will mark out these answers. High energy environments, wave cut notch, wave quarrying and parallel cliff retreat will be employed. The production of the wave cut platform will be an important element in the answer. [12 – 15]

**Level 2**

Descriptions of the landforms will not be matched by the quality of the explanation. There will be some account of the marine processes but less appreciation of the nature of coastal retreat and the production of the wave cut platform. More time will be spent on stumps and stacks, caves etc. [7 – 11]

**Level 1**

Descriptive accounts with little appreciation of the operation of marine processes. Things will be produced by rather unspecific means and the individual erosive processes will be confused and run together. [0 – 6]

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## Hazardous Environments

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

**5 (a) Describe the nature and causes of avalanches.** [10]

Avalanches are a rapid gravitational movement of snow and ice downslope in mountainous terrain. Can be classified according to type of snow, depth of sliding surface, wet or dry snow, track (confined or channelled), whether airborne or ground flow. Wet snow is the most hazardous. They usually occur in spring when melting snow produces vast quantities of water which are absorbed by snow cover. Human activities e.g. skiing can trigger unstable masses.

**(b) Explain how natural events can produce the following hazards:-**

- (i) coastal flooding,
- (ii) severe river floods,
- (iii) landslides.

**To what extent is it possible to protect lives and property from these hazards?**

[15]

### Level 3

Coastal flooding can be produced by hurricanes (tropical storms) or severe storms elsewhere. Water is driven by high winds onto the coasts often breaching coastal defences. The effect is compounded by high tides and by shallow shelving bays such as in Bangladesh. Tsunamis (earthquakes and volcanic eruptions) can produce short term destruction and flooding as seen in 2004.

River floods are the product of excessive rainfall and can be consequent upon the passage of hurricanes. Effects can be exacerbated by human activities.

Landslides. Rainfall from hurricanes earthquakes and volcanic activity can destabilise slopes bringing about catastrophic slope failure. Human lives can be saved by good warning (prediction) of hurricanes and retreat. Tsunamis are more difficult to predict but as always any action (and warnings) is dependent upon wealth.

[12 – 15]

### Level 2

Descriptive of the effects of flooding and landslides rather than the causes. There will be some awareness of the hazards that produce these features but there may be more on actual examples and human impact. The link should, however, be with natural hazards. Remedial action may well be based upon particular examples and will not necessarily apply to all cases.

[7 – 11]

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### Level 1

Accounts of flooding and landslides that have only passing reference to the hazard causing them. Descriptive accounts of the effects rather than causes. Human action will be seen in terms of engineering again little related to the hazard.

[0 – 6]

### 6 (a) Explain how and where earthquakes occur.

[10]

Earthquakes are a series of shock waves due to a sudden movement of crustal rocks. They are generated at a point within the crust. The point where the shock waves (seismic waves) reach the surface is termed the epicentre. The magnitude varies considerably. Most of the seismic activity takes place in association with the margins of tectonic plates - they are particularly frequent around the margins of the Pacific plate. Many will deal with transform boundaries in this context.

- (b) Fig. 3 shows the effects associated with different levels of earthquake magnitude on the modified Mercalli and Richter scales. Using examples, explain the relationship between earthquake effects and the level of earthquake magnitude. How effective have been methods employed to reduce the impact of earthquakes on lives and property?**

[15]

### Level 3

The Richter scale is logarithmic whilst the Mercalli scale is more geared to damage effects. Most hazardous impacts begin to occur after 4 on the Richter scale and the effects escalate as the energy release is increased logarithmically.

Most of the answer will be occupied by the second part of the question. A case study of attempts to both predict and ameliorate the effects of earthquakes. Most will utilise California or Japan, but at this level there must be some evaluation as well as a realisation of the impacts in less wealthy communities.

[12 – 15]

### Level 2

A general statement of increased damage with increased magnitude on both scales. There appear to be significant points at which damage increases. Case studies or methods of earthquake amelioration in terms of buildings, building restrictions, drills and practices, and plans for delivery of essential services and disaster management. Given as examples with relatively little evaluation as to effectiveness.

[7 – 11]

### Level 1

Relatively little attention to diagram save to repeat some of the material; related to particular magnitudes. Most will be on the effects of earthquakes with an unevaluated account of some of the precautionary activities.

[0 – 6]

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## Hot and Semi-Arid Environments

Only **one** question may be answered from this environment

- 7 (a) Describe and explain the weathering processes that occur in hot deserts.** [10]

Mechanical processes of thermal fracture which can lead to block disintegration and exfoliation. Differential expansion of mineral content can lead to granular disintegration. Freeze thaw can occur at altitude and chemical weathering is found in areas of dew, shadow etc. Reasonable coverage can be expected with some exemplification for good marks.

- (b) Describe the hydrological regimes (water flows and stores) in arid and semi-arid environments. How can human activities affect the hydrological regimes in these areas?** [15]

### Level 3

Clearly hydrological regimes are limited under arid conditions but are still of importance. In terms of rivers they are either exotic (Nile) or intermittent and contained within closed basins as they fail to reach the sea. Desert streams (wadis) have high sediment loads when they flow. Erodability of the surface and the intermittent nature of ppt can lead to high drainage densities, such as badlands. Groundwater is often the main water supply which can appear as aquifers in suitable geology or through intermittent recharge via the permeable wadi gravels. Many water supplies are fossil and therefore finite. Human activities are largely exploitative through dams (Aswan) and raising groundwater through bore holes for irrigation. This can lead to salinisation, the invasion of sea water in coastal areas. The removal of vegetation in desert margins has also led to impoverishment of the hydrological regime. A reasonable selection from the above would suffice. [12 – 15]

### Level 2

Channel flow will concentrate upon exotic rivers and centripetal basis with playa lakes. Groundwater will be illustrated by oases. There will be a realisation of the limits of the regimes and how easily that can become exhausted by abstraction. Irrigation will feature as will dams. [7 – 11]

### Level 1

Aridity will feature more than hydrology. A general lack of water supplies save for exotic rivers and oases. Little understanding of groundwater supplies with a concentration upon irrigation activities. [0 – 6]



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- 8 (a) Describe the main features of the climates experienced in hot deserts and semi-arid areas. [10]**

A description here of the desert and semi-arid climates rather than its causes. Thus high day-time temperatures often exceeding 50 C. Colder nights lead to wide diurnal variation. Some variation in temperatures is evident for instance coastal deserts are cooler than those in continental interiors where ground surface temps are even higher. Low levels of rainfall (as low as 0.5 mm) but this is very variable over time. There can be individual storms of considerable magnitude giving rise to severe flooding. Most storms, however, are of low intensity and are very localised. On coastal fringes, fogs occur (e.g. Namibia). Dust storms also occur exacerbated by high temperatures and aridity. In semi-arid areas rainfall is often uncertain and can be interspersed with periods of drought. A seasonal element to some semi-arid climates is evident.

- (b) Fig. 4 shows some landforms found in hot deserts. Describe the landforms named in Fig. 4 and give an explanation of their formation. [15]**

**Level 3**

Essentially the sequence of landforms of the desert piedmont, although illustrated a little differently. The mountain front can be described as well as the detached elements of mesas and buttes depositional elements of the bajada and alluvial apron cover the rock pediment. The internal drainage culminates in a playa. Descriptions need only be brief as most should be devoted to the explanation. This should involve retreat of the mountain front due to weathering and water activity of streams swinging across the pediment are as well as debouching onto it from wadis and embayments in the mountain front. Material from these streams is then deposited in the knick and across the pediment. Mesas and buttes are areas of resistant rock that become detached and eventually form inselberg type features (Monument valley).

**[12 – 15]**

**Level 2**

A standard treatment of the desert piedmont, whether or not the features are present. Hence Mesas and buttes might be overlooked in favour of alluvial fans, wadis etc. The material should be appropriate and some indication given of formation, although there might be some tendency to dwell upon evidence for past pluvial activities.

**[7 – 11]**

**Level 1**

Basic description of the desert piedmont zone with little reference to the diagram. Explanation the features will be rudimentary and reliant upon deposition from streams emerging from the mountain front.

**[0 – 6]**