

## CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

### MARK SCHEME for the May/June 2015 series

#### **9696 GEOGRAPHY**

**9696/22**

Paper 2 (Advanced Physical Options),  
maximum raw mark 50

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## Tropical environments

Only one question may be answered from this topic.

- 1 (a) Describe the nature of nutrient cycling within the tropical rainforest ecosystem and within the savanna ecosystem. [10]

A sensible approach would be to use appropriate Gersmehl type diagrams illustrating the stores and flows of nutrients within the two ecosystems. Inputs will be climatic and losses via leaching of the soils. In TRF, flows from the litter to the biomass are large and rapid. In the case of savanna ecosystems, the stores are more equally balanced with uptake from the litter and soils impeded by lack of rainfall during the dry period. The biomass size is again limited by vegetation die back during the dry season, so the whole system operates less rapidly than the TRF.

If only one ecosystem described: max. 6.

- (b) Using examples, explain how human activities have affected vegetation and soils within either the tropical rainforest ecosystem or the savanna ecosystem. [15]

If the TRF is chosen, deforestation will have a significant effect on the nutrient cycle. This will be demonstrated by the loss of biomass, the largest nutrient store in the TRF, which can lead to the degradation of the whole system. Soils will be deprived of nutrient input and can become exposed to erosion as well as more pronounced leaching. The decline in their nutrients will in turn affect the vegetation that can be sustained. If land is abandoned, only secondary forest can be sustained. If agriculture is practised, then high levels of artificial nutrient input will be required to sustain production.

If the savanna ecosystem is chosen, fire, overgrazing and other factors will lead to the loss of vegetation, both grassland and woodland. The impact of the dry season will require a water supply to sustain agriculture, and herding can lead to nutrient loss, increased laterisation of soils and the possibility of long term soil degeneration. These activities will result in significant changes to the nutrient cycle in the savannah ecosystem.

Some responses may describe schemes about how these ecosystems may be more sustainably used in the future.

### Level 3

Detailed, thorough and accurate explanation of how human activities have affected vegetation and soils within the chosen ecosystem. Appropriate linkages within the nutrient cycle will be established and the consequences of its interruption will be examined.

Appropriate examples are well integrated within the response. [12–15]

### Level 2

Sound and clear explanations of how human activities have affected vegetation and soils within the chosen ecosystem. Appropriate linkages within the nutrient cycle will be suggested with some clear attempt to establish the consequences of its interruption. Appropriate examples may be used but weakly integrated within the response. [7–11]

### Level 1

Basic statements regarding how human activities have affected the chosen ecosystem. Little reference is made to the linkages within the nutrient cycle. Responses may be more descriptive and lacking in clear explanation. [1–6]

For no response, or no creditable response, 0.

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- 2 (a) Fig. 1 and Photograph A show some climatic data and vegetation for a seasonally humid area.

**Using Fig. 1, explain the nature of the climate and how it might influence the type of vegetation shown in Photograph A. [10]**

The climate data shown is for a seasonally humid area in the northern hemisphere. Temperatures range from 21–31°C and peak in April at the end of the dry season. Generally, temperatures are lower in the wet season. The clearer skies during season will lead to a greater diurnal variation.

Rainfall is mainly concentrated between May and September, peaking in August when monthly means can reach as high as 300 mm. There is a dry period of four months between November and February.

The explanation of these characteristics will refer to the overhead position of the sun and wind patterns related to the movement of the ITCZ poleward. In the winter months these climates are more influenced by sub-tropical high pressure as the ITCZ moves back to the equator. During the dry season, the long rooted grasses, shown in the photograph, die back and germinate when the rains arrive. Vegetation has to survive the dry months and therefore favours long rooted grasses that die back in the dry season and germinate when the rains arrive. Trees tend to be drought resistant deciduous.

- (b) Describe the granite landforms that have developed in the humid and seasonally humid tropics. Explain the extent to which the development of these landforms has been influenced by climate and the composition and structure of granite rock. [15]**

The granite landforms in these environments include inselbergs, ruwares, tors, koppies and possibly corestones. Diagrams may be used to illustrate their characteristics and development. Climate is an important factor in providing the heat and moisture to encourage intense chemical weathering that leads to the development of a deep regolith. The mineral composition of granite encourages hydrolysis of feldspars. The structure of the rock is significant in that concentrated jointing creates areas of more rapid weathering separated by less weathered areas where the degree of jointing is less. Climate change also allows the periodic stripping of regolith and the exposure of the landforms through etchplanation or peneplanation.

### Level 3

Detailed, thorough and accurate description and explanation of the granite landforms developed in the humid and seasonally humid tropics. There needs to be a clear evaluation of the importance of climate, rock composition and structure in the development of the granite landforms chosen. [12–15]

### Level 2

Sound description and a clear explanation of the granite landforms. Some attempt made to evaluate the importance of climate, rock composition and structure in the development of the granite landforms. [7–11]

### Level 1

Basic description of some granite landforms with a simple explanation of the processes responsible for their development. Little reference made to the significance of climate, rock composition and structure. [1–6]

For no response, or no creditable response, 0.

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## Coastal environments

Only one question may be answered from this topic.

- 3 (a) Describe the sources of coastal sediments and explain how waves transport and deposit sediments. [10]

Sources of sediment are mainly from rivers supplying sediment to the coastal zone as well as material from erosion of cliffs. The sediments are transported mainly through the processes of suspension and traction. The movement of sediment is by currents (longshore, offshore and tidal) and the process of longshore drift. Sediments are deposited when the energy of waves or currents is insufficient to transport material such as in shallowing water, where the coast changes direction or in estuarine areas.

- (b) Explain how areas of coastal deposition can be influenced by human activities. Using examples, describe the extent to which such coastal areas can be protected. [15]

Human activities influence areas of coastal deposition mostly by the interruption of sediment supply. This reduction of sediment supply can be the result of extraction, dredging or the construction of features such as sea walls, harbours, or groynes. Reduced sediment supply can lead to an increase in erosional processes along the coast with the destruction of spits and beaches and other depositional landforms. Other human activities that can be considered may be dune trampling leading to blow outs, the removal of vegetation and the draining of saltmarshes. Protection can be brought about by management schemes, such as groynes, beach replenishment and dune stabilisation, which ensure sediment supply. However, many of these schemes can create problems of sediment supply elsewhere along the coast.

### Level 3

Detailed, thorough and accurate explanation of how areas of coastal deposition can be influenced by human activities. An effective description of the extent to which coastal areas can be protected and an evaluation of the relative success of the protection schemes. [12–15]

### Level 2

Sound and clear explanation of how areas of coastal deposition can be influenced by human activities. A solid description of the extent to which coastal areas can be protected and an attempt to evaluate the relative success of the protection schemes. [7–11]

### Level 1

Basic description of how areas of coastal deposition are influenced by human activities. Simple comments on the extent to which coastal areas can be protected with little evaluation. [1–6]

For no response, or no creditable response, 0.

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4 (a) Fig. 2 shows some methods that can be used to reduce coastal erosion.

**Describe and explain how methods such as those shown in Fig. 2 can be used to reduce coastal erosion.** [10]

The diagram shows a range of mainly, but not exclusively, hard engineering methods of coastal protection. This also shows the soft engineering methods of beach nourishment and high water protection forest. These methods can be explained in terms of their ability to absorb and disrupt high energy waves and create a barrier between the waves and the coast. Gabions allow sea waves to lose power within the interstices of the rocks. Groynes trap sediment and, as with beach nourishment, defuse the impact of waves. Planting inland can have a similar effect of diffusing wave power that penetrates inland.

**(b) Using examples, explain the extent to which marine erosion and sub-aerial processes can influence the development of landforms along a stretch of coastline.** [15]

The processes of marine erosion, such as hydraulic action, quarrying and abrasion, should be described and explained. In addition, sub-aerial processes, such as weathering and mass movement, should be addressed. A range of landforms can be produced such as cliffs, headlands and bays, wave cut platforms, and the usual range of caves, arches, stacks and stumps. Other significant factors, such as rock type and structure, have a role in landform development.

**Level 3**

A detailed, thorough and accurate explanation of the landforms produced by marine erosion and sub-aerial processes. A clear evaluation of the relative importance of these processes, and other relevant factors, in developing the landforms along a stretch of coastline. [12–15]

**Level 2**

A sound and clear explanation of the landforms produced by marine and sub-aerial processes. Some limited evaluation of the relative importance of these processes, and other relevant factors, in developing the landforms along a stretch of coastline. [7–11]

**Level 1**

A basic description of marine and sub-aerial processes and the landforms produced. Little evaluation of the relative importance of these and other factors in the development of the landforms along a stretch of coastline. [1–6]

For no response, or no creditable response, 0.

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## Hazardous environments

Only one question may be answered from this topic.

**5 (a) Explain how (i) tsunami and (ii) tropical storms (cyclones) develop. [10]**

Tsunami are very large waves generated by violent displacement of the ocean bed as a result of underwater earthquakes and volcanic eruptions. They can also be caused by large underwater landslides. This displacement of large volumes of water creates oscillatory wave motion which moves away from the point of disturbance with a large wave length. As the tsunami approach the shoreline, the wave height increases in the shallower water.

Tropical storms (cyclones) are intense depressions formed at the junction of cold and warm air masses. They form in areas where the surface sea temperature is at least 27°C. This warm water extends to considerable depth (50 metres). The air rises rapidly forming towering cumulonimbus clouds without any wind shearing. The release of latent heat helps to fuel the development of the tropical storm. The centre of the depression has intense low pressure and the coriolis force helps to generate the strong winds spinning around the eye of the storm.

Max. 6 if only one hazard explained.

**(b) Explain how and why tsunami and tropical storms (cyclones) are hazardous to coastal areas. To what extent can their hazardous effects be reduced? [15]**

Both are hazardous because they produce destructive waves that inundate the coastal area and create destruction to buildings and infrastructure and a significant loss of life. In the case of tsunami, the waves are amplified in funnelled coastlines and are particularly hazardous in areas with low lying land and high population densities. Tropical storms (cyclones) have more hazardous elements such as high winds and intense rainfall as well as storm surge. Little can be done to reduce the hazards themselves so prediction, planning and preparation are important elements. Monitoring of both hazards is vital if their hazardous effects are to be reduced and safe evacuation is to be effected. Specific schemes to reduce the hazardous effects include tsunami warning stations (e.g. in Hawaii) and the construction of barriers, e.g. in Japan.

**Level 3**

A detailed, thorough and accurate explanation of how and why both tsunami and tropical storms are hazardous to coastal areas. A clear and sustained evaluation of the effectiveness of the methods used to reduce the effects of both hazards. [12–15]

**Level 2**

A sound and clear explanation of how and why both tsunami and tropical storms are hazardous to coastal areas. A solid but incomplete evaluation of the effectiveness of the methods used to reduce the effects of both hazards. [7–11]

**Level 1**

A basic description of the hazards caused by tsunami and tropical storms. Limited evaluation of the measures used to reduce the effects of one or both hazards. [1–6]

For no response, or no creditable response, 0.

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6 (a) Fig. 3 shows a hazard map of a volcano.

**Describe the nature of the erupted materials shown in Fig. 3 and explain their hazardous impacts.** [10]

Each of the materials should be described and their hazardous impacts assessed. Some indication of the severity of the hazards can be described with reference to Fig. 3. The hazardous impacts might range from the devastating effects of pyroclastic flows to the relatively moderate consequences of tephra (ash).

**(b) Explain the causes of earthquakes. To what extent are the hazardous effects of earthquakes more difficult to manage than the hazardous effects of volcanoes?** [15]

Earthquakes occur mainly along all types of plate boundaries and are due to the friction engendered by plate movement and the development of seismic waves. Intra-plate earthquakes can occur and are thought to be caused by friction and movement along faults. Earthquake hazards are generally more difficult to manage due to their unpredictability. Locations and timing are difficult to ascertain despite considerable research effort.

However, locations of volcanoes are known and monitoring methods have proved more effective at predicting eruptions and hence managing their hazardous effects. To counter ground shaking in earthquakes (the prime cause of the hazard), steps can be taken to strengthen buildings and protect public utilities. On the other hand, little can be done to mitigate pyroclastic flows and volcanic explosions.

**Level 3**

A detailed, thorough and accurate explanation of the causes of earthquakes. A sustained evaluation of the relative success of management techniques used in relation to earthquakes and volcanoes. [12–15]

**Level 2**

A sound and clear explanation of the causes of earthquakes. A solid evaluation of the relative success of management techniques used in relation to earthquakes and volcanoes. [7–11]

**Level 1**

A basic description of the causes of earthquakes. Little understanding and assessment of the different management methods used in relation to earthquakes and volcanoes. [1–6]

For no response, or no creditable response, 0.

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## Arid and semi-arid environments

Only one question may be answered from this topic.

- 7 (a) Describe and explain the similarities and differences between the characteristics of hot arid and semi-arid climates. [10]

Hot arid climates are noted for their lack of rainfall, usually accepted as less than 250 mm annually, whereas semi-arid climates generally have 250–500 mm. In hot arid climates, the rainfall is characterised by long periods without any rainfall, highly localised rainfall and intensive convective downpours. In semi-arid areas the rainfall is characterised by seasonal rainfall, connected with the movement of the ITCZ and its unreliability.

Temperatures in both are high with diurnal ranges exceeding annual. Hot arid areas often have high wind speeds and semi-arid climates exhibit cooler seasons.

Explanation of hot arid climates will be in terms of sub-tropical high pressure systems, continentality, rain shadow and ocean currents. Semi-arid will be seen as marginal to these and therefore transitional climates.

- (b) Explain the extent to which the vegetation of arid areas is different from that of semi-arid areas. [15]

In both arid and semi-arid areas, vegetation has to adapt to the lack of moisture. As a consequence, xerophytic, phreatophytic and halophytic elements will appear in both. Examples of specific adaptations can be explained which involve reference to water retention, leaf adaptations, stomata characteristics and depth of root systems. Due to the higher amounts of rainfall, semi-arid vegetation can be more diverse with grasses, sage brush, some shrub layers and, in favoured locations, some trees.

### Level 3

A detailed, thorough and accurate explanation of the differences in vegetation in arid and semi-arid areas. A sustained evaluation of the degree to which the vegetation in these areas differ. [12–15]

### Level 2

A sound and clear explanation of the differences in vegetation in arid and semi-arid areas. A solid but incomplete evaluation of the degree to which the vegetation in these areas differ. [7–11]

### Level 1

A basic description of the vegetation in one or both areas. Little or no evaluation of the differences. [1–6]

For no response, or no creditable response, 0.



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8 (a) Photograph B shows some desert landforms.

**Using a labelled diagram, describe the landforms shown in Photograph B and explain their development.** [10]

The photograph shows a wadi that has become infilled with sediment, boulder strewn slopes in the foreground, and gullies on the slopes in the background. Traces of dry stream channels are indicated by the distribution of the vegetation. An explanation for the wadi can be given in terms of fluvial action, often flash flooding, as a result of infrequent present storms. The role of past pluvial action is also a possible explanation. The infilling of the wadi can also be the result of water and wind action. The gullies on the slope can be explained by water action as a result of infrequent rainfall events. The boulder strewn slopes can indicate the effects of insolation weathering.

**(b) Describe the problems to be overcome in the sustainable development of either arid areas or semi-arid areas. Using an example or examples, evaluate attempts to overcome these problems.** [15]

The problems are those of aridity and harsh climatic conditions in either area that make it difficult to support anything other than low population densities. In semi-arid areas, there is a range of irrigation schemes, such as the construction of dams and water transfer, that aim to raise the level of agricultural productivity in a sustainable manner. Other potential developments may relate to gathering of solar energy and its use to power water desalination, greenhouse and hydroponic cultivation.

**Level 3**

A detailed, thorough and accurate description of the problems to be overcome in the sustainable development of the chosen area. A sustained evaluation of the attempts to overcome the problems identified with effective reference to specific examples. [12–15]

**Level 2**

A sound and clear description of the problems to be overcome in the sustainable development of the chosen area. A solid evaluation of the attempts to overcome the problems identified with some reference to specific examples. [7–11]

**Level 1**

A basic and incomplete description of the problems to be overcome in the sustainable development of the chosen area. Little or no reference to examples with minimal evaluation of attempts to overcome the problems mentioned. [1–6]

For no response, or no creditable response, 0