Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

GEOGRAPHY **9696/21**

Paper 2 Advanced Physical Options **October/November 2016**

MARK SCHEME

Maximum Mark: 50

Published

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

Tropical environments

1 (a) Photographs A and B show contrasting seasons of a tropical monsoon climate.

Describe and explain the contrasting weather experienced during the different seasons of a tropical monsoon climate. [10]

Descriptive points are the three seasons of the monsoon: cool dry, hot dry followed by the breaking of the monsoon. However, accept two seasonal contrasts with some apposite data for extra credit in both cases.

Explanations should be in terms of the movement of the ITCZ but especially the contrast between the winter high pressure and summer low pressure and the resultant pattern of monsoon winds. The best answers will draw on a well detailed example.

(b) With reference to <u>either</u> granite <u>or</u> limestone, assess the importance of structure and composition in the development of landforms in tropical environments. [15]

Structure is important, especially the degree of jointing allowing ingress of acidic solutions and exposing large surface areas to weathering, hydrolysis or carbonation.

Composition should focus on chemical composition, granite acidic and limestone alkali but more specifically feldspars in granite and calcium carbonate in limestone. Erosion contributes to the removal of regolith, the product of weathering, and development of landforms. Uplift could be significant which might be isostatic or tectonic. Some may attempt to cover both humid tropical as well as seasonally humid with physical weathering considered in the latter. Some credit is possible but not freeze thaw. The roles in the development of landforms should be linked to features such as ruwares, bornhardts, koppies/tors or tower and/or cockpit karstic landforms.

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 [12–15]
Accurate and detailed knowledge with balanced coverage of factors and processes, their roles being well evaluated in the development of appropriate landforms.

Level 2 [7–11]
Good knowledge of factors and processes at the upper end of the level and understanding of the stages in the development of landforms. More partial answers at the lower end of this level with limited evaluation.

Level 1 [1–6]
Awareness of appropriate factors and processes but lacking accurate or detailed knowledge. Appropriate landforms named but limited development and no evaluation of the factors. Caves and stalactites likely to be the principal ‘karstic’ features in the case of limestone.

For no response or no creditable response. **[0]**

2 (a) Describe and explain nutrient cycling in tropical rainforest ecosystems and savanna ecosystems. [10]

Description will be most effectively shown by Gersmehl or similar diagram(s) to detail biomass, litter and soil stores, flows between them as well as inputs and outflows of nutrients. The pattern is the same for both ecosystems but stores and flows will be different.

Explanation should centre on the processes such as decomposition, humification, leaching, and how they may be accelerated or slowed in the two ecosystems.

(b) For either a tropical rainforest ecosystem or a savanna ecosystem, explain the need for sustainable management and evaluate the extent to which the management has been successful. [15]

The need will be that if there is no sustainable management, exploitation will lead to the loss of vegetation cover, soil fertility, structure and erosion, reduced precipitation and reduction/loss of nutrient cycling. The syllabus demands a case study of such issues and solution(s). Apart from selective logging, 'fell a tree plant two', agroforestry and licensing in tropical rainforests or game reserves and ecotourism in the savanna, etc., there are many well documented schemes where the aim to maintain the ecosystem is paramount, such as the Milpa system in Mexico and game farming in South Africa.

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 [12–15]
There will be full awareness and accurate detailing of the need for sustainable management. There will be a well presented and fully evaluated account of a project, or projects, with sustainable management of the ecosystem at its, or their, focus.

Level 2 [7–11]
The need will be presented in more general terms although aware of principal elements. Appropriate scheme, or schemes, but with limited focus on addressing the problems or evaluation at the lower end of the level.

Level 1 [1–6]
There will be limited attention to and/or lack of detailing the need. It will be lacking in a specific scheme or system and will present basic approaches such as licensing and policing exploitation, ecotourism or unfeasible suggestions.

For no response or no creditable response. **[0]**

Coastal environments

3 (a) Describe the marine erosion processes of hydraulic action, wave quarrying and corrasion/abrasion. Explain the factors that make these processes effective in the development of cliffs. [10]

Hydraulic action is wave pounding, although often confused with quarrying; most effective when storm waves break against the base of a cliff releasing great energy (up to 30 tonnes/sq.m).

Wave quarrying is the compression of air within cracks in rocks by wave impact followed by the sudden decompression as the water recedes. This creates an explosive effect which can in time open up cracks.

Corrasion/abrasion is where breaking waves use available sediments such as pebbles and cobbles to grind, wear away, i.e. abrade or corrade, the cliff base.

The factors are the resistance of rocks such as granite or less resistance of incoherent rocks such as weakly cemented sandstones or clays. Also important will be the degree of jointing or faulting making quarrying effective.

(b) For a stretch or stretches of coastline, describe measures that might be considered to solve problems needing sustainable management. Evaluate attempted solutions to the problems. [15]

This will probably elicit a range of hard and soft engineering options but the problems should be stated. Expect approaches such as: 'hold the line', 'do nothing' and 'managed retreat'. A wide range of examples of coastal stretches are available and quality of answers will be in terms of the accuracy and detail of knowledge, understanding of the problems and, importantly, evaluation.

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 [12–15]
Explanation will be central as will clear understanding of problems. An accurate, well documented example with a balanced evaluation.

Level 2 [7–11]
The response covers appropriate measures with some attention to the problems. There will be a relevant example of a scheme but with both limited accurate detail and evaluation at the lower end of the level.

Level 1 [1–6]
The response will essentially be a list rather than explanation with structures such as sea walls, groynes and gabion cages and beach nourishment mentioned without application to the problems. There will be random examples with little or no evaluation.

For no response or no creditable response. **[0]**

4 (a) Fig. 1 shows depositional landforms of a lowland coast.

Describe and explain the factors and processes which influence the development of landforms A, B and C, shown in Fig. 1. [10]

A – An offshore bar deposited by backwash combing sediment down the beach by destructive (high energy) waves with an erosion channel breached by returning currents.

B – Beach ridge or berm pushed up by depositional constructive waves (low energy).

C – Fore dune (marram grass stabilising). Credit processes of wind transport and deposition detail across a drying low tide exposed sand beach.

Maximum mark for any one, 4.

(b) Explain why the conditions required for the growth of coral reefs are under threat. To what extent can the impact of these threats be managed? [15]

Knowledge of the conditions should emerge as threats are explained, such as sediment discharge from farming and construction clouding the water. Other threats might be warm water discharge from power stations and processing plants. Discharge of nitrite fertilizers causes algal blooms, and oil discharge creates a film blocking strong light transmission. Structural damage from some types of fishing and tourist activities disturbs water movement and a firm base for coral growth. No doubt there will be much attention given to global warming. As usual, two well developed threats could qualify for maximum credit.

Management would be mainly through legislation to limit threats with specific examples such as conservation areas (Great Barrier Reef), banning certain types of fishing and tourist activities. Evaluation may stress the limited extent of management but again two well developed cases could gain full credit. Non-human threats may also be considered, hurricanes, tsunami, alien species (crown of thorns starfish).

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 [12–15]
The response will be a full and accurate explanation focused on the conditions for at least two examples. There will be a balanced appraisal of the possibilities of management. Examples will be fully apposite.

Level 2 [7–11]
There will be a more general account of threats less focused on the conditions, but relevant examples and understanding of management limitations.

Level 1 [1–6]
The response will be descriptive with limited accurate detail with listing rather than explanation and structural damage dominating. Management may be in terms of ‘education’ and penalties with no evaluation.

For no response or no creditable response. **[0]**

Hazardous environments

5 (a) Describe the nature and explain the causes of <u>two</u> types of hazardous mass movement. [10]

Allow two distinct types of avalanche, i.e. rock debris and snow, but not two types of snow avalanche. Others might be landslide, rock fall and mudslide/lahars. There could be a case for two distinct types of landslide, i.e. massive slope failure and rotational slumping.

Explanation should be in terms of shear strength being overcome by shear pressure from saturation of a slope and overloading or removal of a foot slope by either human or physical causes. Snow avalanches may be caused by sudden temperature rise or some tipping point being reached and activated by movement or even loud noise. Many will state that mass movements are caused by earthquakes, whereas they are only a trigger where slopes are already at some critical state of stability.

(b) Fig. 2 shows a cross section of a tropical storm (cyclone).

Explain the development of tropical storms (cyclones). Evaluate the extent to which the hazardous impacts of tropical storms (cyclones) may be managed. [15]

Important factors are sea temperatures of >26 ºC and depth of >100 m; these ensure supply of warm moist air. Location within a belt between 5 º and 25 º N and S of the equator where converging air masses meet and the Coriolis force is exerted to create spin to the system. Processes are the development of an atmospheric disturbance caused by warm air undercutting a cooler mass generating uplift which can lead to a hurricane forming. The processes of uplift and condensation of warm moist air release latent heat which fuels the rotating system which moves westwards under the influence of the global wind systems. Diagrams will often clarify processes and should be fully credited if accurate.

Their hazardous impacts come from high winds (>250 km/h at Category 5); structural damage and danger from flying objects; torrential rain (>300 mm in one storm); river floods, landslides and storm surges (>5 m above mean sea level); extensive coastal flooding and destruction. Management includes forecasting, warning and evacuation, sea walls and river levees, land use and land zoning. Some may contrast MEDCs with LEDCs and many will devote too much to this and to a range of human measures, education, insurance, etc., often not linked specifically to hurricanes.

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 [12–15]
The response will be a full coverage of the demands with accurate knowledge of both the genesis of hurricanes and understanding of the hazards, and evaluated possibilities for their management.

Level 2 [7–11]
The response will show a less secure knowledge of genesis and less precise detailing of the hazards but coverage of relevant management options with a degree of evaluation.

Level 1 **[1–6]**
There will be a very imprecise knowledge of genesis, confusion of hazards with tornadoes and lack supportive data. There will be a very limited account of measures to manage hazardous impacts.

For no response or no creditable response. **[0]**

6 (a) Explain the causes and location of <u>two</u> different types of volcanic eruption. [10]

Both causes and location are needed. The contrast in types will most likely be explosive andesitic eruptions at destructive margins (St Helens), effusive basaltic ones at constructive margins (Iceland) or mixed types at hot spots (gentle oceanic, Hawaiian or potentially cataclysmic, Yellowstone). Well annotated diagrams should be accepted for full credit.

Nominally 5 + 5 but 6 + 4 is also possible.

(b) Explain the nature of hazards which may be caused by earthquakes. To what extent is it possible to predict earthquakes? [15]

The hazards listed in the syllabus are shaking, landslides and tsunami and will be sufficient for full credit. However, liquefaction will no doubt feature in good answers and it is a result of shaking from seismic waves as is the shaking of built structures.

Landslides are more strictly triggered than caused by earthquakes and good candidates will detail how. Similarly, detail is required for how tsunami may be generated by displacement of sea water and not the mere earthquake itself.

For prediction: very little is the answer but reasons are needed. Techniques such as seismic gap theory, pre-event tremors, radon gas, changes in water table levels, strain meters and no doubt animal behaviour may be considered. A key point is that even if an event is being predicted, unlike a volcanic eruption, precise location or probable timing are almost impossible to predict.

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 **[12–15]**
The response will show genuine knowledge and very good understanding of the physical processes and outcomes. It will be realistic, accurately detailed and with well evaluated possibilities of prediction.

Level 2 **[7–11]**
The response will cover appropriate hazards but may be lacking precise understanding of the processes at the lower end of the level. A range of predictive techniques will be discussed but less well evaluated.

Level 1 **[1–6]**
There will be a very limited coverage of hazards with inaccuracies and weak understanding of processes. There will be an uncritical and limited range of predictive techniques with possible undue weight to the role of animal behaviour.

For no response or no creditable response. **[0]**

Arid and semi-arid environments

7 (a) Using <u>three</u> examples, explain how animals are adapted to the climatic characteristics of hot arid environments. [10]

Examples could be either specific species or adaptations. If the latter, then reference to a species is needed for full credit. The main issues are how to cope with lack of water and extreme daytime heat. For the former: water from food and plant juices (mice, snakes), travelling to find water (camels), fog/dew (snakes, beetles), 'sleeping', i.e. *estivation* during dry periods (toads), kidney power, reducing water in urine (kangaroo rats). To combat heat animals may: be nocturnal (rodents, lizards, snakes), store fat concentrated in areas to allow heat loss from other parts (camels), have big ears and long legs (jackrabbits, desert foxes, camels – long legs).

(b) Photograph C shows desertification in a semi-arid environment.

Outline the processes of desertification. Assess the extent to which desertification is caused by physical factors. [15]

Desertification is either the encroachment of desert into marginal areas due to deflation and wind transport often leading to dune migration, or loss or reduction of vegetation leading to the exposure of areas of soil and deflation as the surface dries to 'dust'. It is inevitable that candidates will detail the human causes, such as overgrazing and overcultivation, and these are relevant as long as stage by stage processes are described. The command word is 'Outline', so that extended accounts of causes are not relevant in the first part. The major physical factors are climate change, extended periods of drought, the generally poor soil structures due to low organic content and strong unidirectional winds.

Assessing these causes against the undoubted human causes will determine the quality of answers. However, overgrazing, depletion of any tree cover for building and fuel, inappropriate cultivation and irrigation are all exacerbated by increasing population pressure. The best answers will employ examples such as the Sahel and show a good understanding of a marginal physical environment.

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 [12–15]
The response will be an accurately detailed stage by stage analysis of the processes of desertification. There will be a genuine assessment of physical causes as well as the extent to which they are, or are not, the primary explanation for desertification. The answer will be substantiated by relevant examples.

Level 2 [7–11]
Both demands will be addressed with an emphasis on the human factors in both and with less understanding of the processes as such. The assessment of the causes may be unbalanced and general rather than with specific exemplification.

Level 1 [1–6]
The response will be descriptive with limited or no explanation of the processes, and examination of the causes will refer mainly to human activities. There will be limited or no exemplification.

For no response or no creditable response. **[0]**

8 (a) Describe the weathering processes that operate in hot arid environments. Explain the results of weathering on rocks. [10]

The weathering processes will be thermal fracturing or insolation weathering, salt crystallisation, plus some reference to chemical weathering, but no frost shattering.

Results will be block and granular disintegration, spalling and pitting, related to the lithology and structure of the rocks. Explanation is required as well as description.

(b) 'The landforms of desert environments are the result of past climatic conditions.'

To what extent do you agree with this statement? [15]

Any level of 'agreement' or otherwise must be supported by evidence. Apart from sand dunes and minor erosion features due to wind abrasion, running water plays the dominant part in the production of most desert landforms. Present day wadi and wadi systems mainly owe their existence to past pluvial periods and are affected today by mainly flash floods which transport accumulated debris. Such sediments deposited at the exit of wadis create alluvial fans and bahadas.

Evidence should be the scale of wadis and the fully integrated valley systems plus former lake shorelines (Chad). Currently only intermittent streams carry fine silt and salts into internal drainage basins to playas creating salt lakes. Sand sheets probably owe their origin to earlier deposition in flood plains by water. Hence, even sand dunes developed under a present climate owe their development to past conditions in providing the sand. Some may argue strongly from the standpoint of the ineffectiveness of wind erosion and only occasional flash floods of running water at the present day.

Award marks based on the quality of explanation and breadth of the response using the marking levels below.

Level 3 [12–15]
There will be thorough and accurate analysis of evidence from a range of landforms, both erosional and depositional, with accurate explanation and evaluation in terms of both past and present day climatic conditions.

Level 2 [7–11]
There will be a more limited range of landforms discussed with less accurate evidence. There will be an awareness of the role of past pluvials, but not the scale at the lower end of the level.

Level 1 [1–6]
The response will be very limited with weak knowledge and understanding of landforms. There will be understanding of the role of past pluvial periods and hence very limited discussion, if any, of evidence.

For no response or no creditable response. **[0]**