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GEOGRAPHY **9696/22**

Paper 2 Advanced Physical Options **October/November 2017**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks
1(a)	**Fig. 1 shows a tropical soil catena.** **With reference to Fig. 1, describe and explain the downslope variations in soil characteristics.** This is a typical savanna catena. There are thin immature soils on the steep slopes close to the plateau top with perhaps a laterite (plinthite) capping. The normal ferruginous soil occurs on the freely drained main slope. However, the downslope movement of both soil and especially solutes of iron and aluminium accumulate on the lower slopes. Water, draining as throughflow, also accumulates on the lower slopes leading to waterlogging and mottling in the soil profile. At the slope base, where the soils are more continuously waterlogged, gleyed black soils (vertisols) with swelling clays occur. Description and explanation will probably be intertwined. The climatic characteristics (this is a savanna catena as shown by the vegetation and soil) could be part of the explanation.	**10**

Question	Answer	Marks
1(b)	**Describe the characteristics of the vegetation in savanna ecosystems. Assess the extent to which vegetation in savanna ecosystems has been influenced by human activities.** The question asks for a discussion of vegetation, which should include vegetation structure as well as the nature of the plant communities. Better examples may include a description of the gradation from the tropical rainforest boundary to semi-arid areas from tree to grassland savanna. The question asks for an assessment, therefore factors other than human activities need to be considered. There is scope to explain the difference between climatic climax vegetation and plagioclimax as a result of human activities. The human activities that are relevant include fire, overgrazing and cultivation. These activities will result in significant changes to the natural vegetation. Better answers will mention the transition from the TRF boundary and that vegetation in savanna ecosystems exhibits considerable variety. **Level 3** **12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding of savanna vegetation. There is clear description and detailed explanation of the vegetation characteristics. The evaluation of the extent to which human activities have affected the vegetation is thorough. Where relevant, examples used are appropriate and integrated effectively into the response. **Level 2** **7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding of savanna vegetation. There might be a lack of balance between description and explanation. Some examples are used but may lack detail or development. Expression may be unclear in places. **Level 1** **1–6** Response comprises a few points which address the question simply or in part. Knowledge is basic and understanding of savanna vegetation may be inaccurate. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**

Question	Answer	Marks
2(a)	**Describe and explain the development of deep weathering profiles on granite in tropical environments.** Although the question does not ask for a diagram, expect most candidates to produce one. Much of the description can be provided in a well annotated diagram. Explanation will be in terms of the nature of granite (mineralogy and jointing) and the climatic characteristics with intense chemical weathering (mainly hydrolysis) producing the features and depth of the weathering profile. The syllabus mentions the basal surface of weathering (weathering front) which is often ignored. There needs to be a balance between description and explanation for good marks.	**10**

Question	Answer	Marks
2(b)	**Explain why it may be difficult to sustainably manage areas within <u>either</u> the tropical rainforest ecosystem <u>or</u> the savanna ecosystem. Evaluate the success of attempted solutions to the difficulties identified.** In the case of the TRF, the problems are mostly due to the nature of the nutrient cycle and the sensitivity of the environment. Most nutrients are contained in the biomass and the cycle is rapid such that any disturbance will lead to nutrient loss, soil deterioration and a degraded vegetation with great loss of biodiversity. Ways to overcome this should be expressed in terms of particular projects such as selective logging, restricted agricultural developments and specific conservation measures. In savanna areas, the main problems are the seasonal drought, unreliability of rainfall, fire and the nature of the mostly lateritic soils. As a result, agriculture is difficult. The soils are naturally lacking in nutrients and therefore need the application of fertilisers. Such soils are also prone to water and wind erosion and therefore need careful management. Grazing needs to be controlled and the crops grown should be adapted to the climatic conditions. Other activities could include safari tourism and game reserves. **Level 3 12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding and explanation of the problems associated with the chosen ecosystem. There is detailed assessment of these problems with thorough evaluation of attempted solutions. Where relevant, examples used are appropriate and integrated effectively into the response. **Level 2 7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding but both problems and solutions to these problems are discussed and assessed in a partial way. Some examples are used but may lack detail or development. Expression may be unclear in places. **Level 1 1–6** Response comprises a few points which address the question simply or in part. Knowledge is basic and understanding of problems and solutions to these problems in the chosen ecosystem may be inaccurate. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**

Question	Answer	Marks
3(a)	**Photograph A shows some landforms along a stretch of coastline.** **With the aid of a labelled diagram, describe the landforms in Photograph A and explain how they may have developed.** The photograph shows a cliffed coastline with arch, stack and wave cut platform. There is also evidence of mass movement processes on the face of the cliffs and wave refraction within the small bay. Explanation will be largely in terms of marine erosion (such as hydraulic action, abrasion, cavitation) acting on weaknesses in the rock (joints, bedding planes) leading to undercutting and cliff retreat with the formation of cliffs, wave cut platform and headlands and bays. The headland will be seen to have progressed from cave to arch to stack. Better answers will see evidence of sub-aerial processes. If no diagram, maximum 6 marks.	**10**
3(b)	**Using specific examples, describe the problems of the sustainable management of a stretch or stretches of coastline. Evaluate attempted solutions to these problems.** This is an opportunity to develop a relevant example of a management scheme or schemes and/or case study of a specific coastal area. There needs to be a thorough description of the problems. Solutions may be seen in terms of hard and soft engineering as well as procedures such as hold the line, managed retreat and a do nothing approach. The emphasis is on sustainable management so this needs to be a major part of the evaluation. **Level 3** **12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding of the problems of the chosen stretch or stretches of coastline with a thorough evaluation of possible sustainable management. Examples used are appropriate and integrated effectively into the response. **Level 2** **7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding of the problems of the chosen stretch of coastline with a partial evaluation of possible sustainable management. Examples may lack detail or development. Expression may be unclear in places. **Level 1** **1–6** Response comprises a few points which address the question simply or in part. Knowledge is basic and understanding of the problems of the chosen stretch of coastline may be inaccurate. Evaluation will be severely limited and unsubstantiated. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**

Question	Answer	Marks
4(a)	**Describe how sediment is transported and deposited along coastal areas. Explain how these processes lead to the formation of <u>two</u> coastal landforms.** Sediment transportation is the result of the interaction of waves, currents and wind and the nature of the sediments available for transport. Thus description of the modes of transport (suspension, saltation, traction) is relevant as are the effects of wave energy. The process of longshore drift could be emphasised as could swash/backwash processes on beaches. Depositional landforms listed in the syllabus are beaches, spits, tombolos, offshore bars, barrier beaches, coastal dunes and salt marshes. Explanation of the landforms needs to be with respect to the processes of transport and deposition.	**10**
4(b)	**Discuss the relative importance of mass movements in the evolution of cliffs.** Although the emphasis will be on the nature of mass movements and how they are related to the evolution of cliffs, the influence of other factors, such as marine processes and rock structure and lithology, needs reasoned assessment. The emphasis is on the evolution of cliffs, not just a description of basic cliff profiles. Mass movements could include rockfalls, mudflows and landslides. There needs to be more than one type of mass movement. It could be stressed that without the removal of material created by mass movements, the evolution of cliffs will be stalled. **Level 3** **12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding of the evolution of cliffs with a thorough evaluation of the relative importance of mass movements in their evolution. Where relevant, examples used are appropriate and integrated effectively into the response. **Level 2** **7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding of the evolution of cliffs with a partial evaluation of the relative importance of mass movements in their evolution. Some examples are used but may lack detail or development. Expression may be unclear in places. **Level 1** **1–6** Response comprises a few points which address the question simply or in part. Knowledge of the evolution of cliffs is basic and understanding may be inaccurate. Evaluation of the relative importance of mass movements and other factors will be limited and unsubstantiated. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**

Question	Answer	Marks
5(a)	**Fig. 2 shows an erupting volcano.** **Describe the characteristics of pyroclastic flows and ash fallout, and explain how they might be hazardous.** The characteristics of the material involved in pyroclastic flows (ash, gas and larger particles) should be mentioned as well as speed and temperature characteristics. These features make such flows extremely hazardous as they hug the slope, are not restricted by topographic effects and flow for considerable distances. The dangerous effect of ash fallout arises because of the great distances it can travel causing disruption to air traffic. Large ash falls near the volcano might lead to roof collapse and will affect agriculture, livestock and humans such as by inhalation and ingestion. Explanation for lahars, if well explained, is also relevant.	**10**

Question	Answer	Marks
5(b)	**To what extent are methods used to predict earthquakes more successful than methods used to predict volcanic eruptions?** Methods of prediction for earthquakes include the use of seismographs, crustal deformation, geochemical and groundwater changes, radon gas emission, magnetic and electrical changes and, inevitably, animal behaviour. Methods for predicting volcanoes include seismic tremors, ground bulging, electrical and magnetic changes, gas emission, groundwater changes and heat increases. Earthquakes are much more difficult to predict and candidates should note the very few cases where prediction has been successful compared with the prediction of volcanic eruptions. There needs to be substantive evaluation of the success or otherwise of the prediction methods. **Level 3** **12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding of prediction techniques for both earthquakes and volcanic eruptions. There is thorough evaluation of the relative success of these techniques that is based on reasoned argument. Where relevant, examples used are appropriate and integrated effectively into the response. **Level 2** **7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding of prediction techniques for both earthquakes and volcanic eruptions. Evaluation of the relative success of these techniques is based on superficial evidence. Some examples are used but may lack detail or development. Expression may be unclear in places. **Level 1** **1–6** Response comprises a few points which address the question simply or in part. Knowledge is basic and understanding of prediction techniques for both earthquakes and volcanic eruptions may be inaccurate. Evaluation of the relative success of these techniques is unsubstantiated. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**

Question	Answer	Marks
6(a)	**Describe the nature of tornadoes and explain how they develop.** They are intense rotating masses of air with extreme wind speeds and often intense precipitation quite often of large hail stones. They are local meteorological hazards and are usually less than a kilometre wide, but the track can extend for many kilometres. Tornadoes develop from supercells (mesocyclones), an area of organised rotation extending vertically some kilometres into the atmosphere. Convergence of warm and cool air causes a rotating wall of cloud to form. As uplift intensifies, an area of intense low pressure is created and the processes continue, aided by latent heat transfer.	**10**
6(b)	**Describe and explain the nature of <u>two</u> types of mass movement. Assess the extent to which the hazardous effects of mass movements can be limited.** No specific mass movements are listed in the syllabus; therefore the chosen types will vary, for example landslides, rockfalls, mudflows and snow avalanches. The explanation will depend on the nature of the mass movements chosen. Measures to limit the effects will also depend on the chosen mass movements, but could include drainage of slopes, regrading, and various hard engineering procedures such as rock bolts, shotcrete, netting and afforestation of potentially unstable slopes. Land use zoning is also a possibility. **Level 3** **12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding of two types of mass movement. Assessment of the extent to which the hazardous effects of mass movements can be limited is accurate and thorough. Where relevant, examples used are appropriate and integrated effectively into the response. **Level 2** **7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding of two types of mass movement. Assessment of the extent to which the hazardous effects of mass movements can be limited is partial in some respects. Some examples are used but may lack detail or development. Expression may be unclear in places. **Level 1** **1–6** Response comprises a few points which address the question simply or in part. Knowledge is basic and understanding of two types of mass movement may be inaccurate. Assessment of the extent to which the hazardous effects of mass movements can be limited is unsubstantiated and may be absent. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**

Question	Answer	Marks
7(a)	**Photograph B shows vegetation in a hot arid environment.** **Describe the characteristics of the vegetation shown in Photograph B. Explain how vegetation has adapted to the conditions of a hot arid environment.** Vegetation shown in the photograph includes cacti, thorn shrubs, low bushes, etc. The characteristics described need to be based on what can be seen in the photograph. Little credit should be given to general characteristics of hot arid vegetation that are not visible in the photograph. Vegetation in hot arid environments is adapted to heat and lack of water. Explanation of this adaptation will involve measures to conserve water such as succulent stems, spines and hairs to reduce water loss, long tap roots and extensive lateral roots. Some vegetation types give off noxious substances to deter other plants from growing too close. Description of adaptation to saline conditions is also relevant.	**10**

Question	Answer	Marks
7(b)	**Describe the process of desertification. Evaluate measures that might be used to sustainably manage areas that have been desertified.** In order to answer this question, desertification will need to be described and explained. Desertification is usually a characteristic of semi-arid areas but can occur in other environments, such as savannas. Such areas are highly sensitive to periods of drought and/or overexploitation, which may lead to soil erosion, and vegetation and land degradation. There are many schemes that have been advanced for desertified areas which can be described and evaluated, such as irrigation schemes, afforestation and re-afforestation, and the management of pastoral activities. The schemes need to be devised so that they reinforce the natural powers of regeneration. **Level 3** **12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding of desertification. Evaluation of measures to sustainably manage such areas is based on sound evidence and sustained argument. Where relevant, examples used are appropriate and integrated effectively into the response. **Level 2** **7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding of desertification. Evaluation of measures to sustainably manage such areas is partial and based on limited evidence. Some examples are used but may lack detail or development. Expression may be unclear in places. **Level 1** **1–6** Response comprises a few points which address the question simply or in part. Knowledge is basic and understanding of desertification may be inaccurate. Evaluation of measures to sustainably manage such areas is unsubstantiated and based on little evidence. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**

Question	Answer	Marks
8(a)	**Explain the processes of erosion, transport and deposition by wind in deserts.** The syllabus lists corrasion/abrasion and deflation for erosion, and suspension, traction and saltation for transport. There needs to be balanced coverage of these processes. Deposition will require a drop in wind strength depending on the size of material being transported and perhaps some obstacles for deposition to occur.	**10**

Question	Answer	Marks
8(b)	**For an arid or a semi-arid environment, to what extent does climate create problems of sustainable management?** The detail will depend on the chosen environment but will be quite similar. Climatic limitations in both environments include lack of precipitation and high temperatures, low humidity levels and strong winds. This leads to low biomass productivity. Soils in general are sandy, infertile, lacking in organic matter and often highly saline because of the upward movement of water by capillary action. The nature of the soils will vary between arid and semi-arid environments. This means that agriculture is extremely difficult, if not impossible. The lack of vegetation also inhibits pastoral activities with nomadic herders having to move considerable distances to obtain even limited grazing. Low biomass productivity also means that such areas can rapidly degenerate because of the low recovery rates. The only difference between the two environments is that in hot arid areas these characteristics are more extreme. For a thorough assessment, the links between climate and these other factors would be expected. **Level 3 12–15** Response addresses the question fully and is well focussed. Response is well founded in detailed knowledge and strong conceptual understanding and thorough evaluation of the problems caused by climate for sustainable management in the chosen environment. Where relevant, examples used are appropriate and integrated effectively into the response. **Level 2 7–11** Response is partial in addressing the question and focus is not maintained. Response develops on a largely secure base of knowledge and understanding and evaluation of the problems caused by climate for sustainable management in the chosen environment, but may be partial in some respects. Some examples are used but may lack detail or development. Expression may be unclear in places. **Level 1 1–6** Response comprises a few points which address the question simply or in part. Knowledge is basic and understanding and evaluation of the problems caused by climate for sustainable management in the chosen environment will be unsubstantiated and may be inaccurate. Examples are in name only or lacking entirely. Expression is unclear. No response, or no creditable response **0**	**15**