Cambridge International AS Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary Level

ENVIRONMENTAL MANAGEMENT **8291/21**

Paper 2 **October/November 2016**

MARK SCHEME

Maximum Mark: 80

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.

Question	Answer	Marks
Section A		
1(a)(i)	Arctic Ocean summer sea ice, has less extent in 2007 compared to the average value for 1979 to 2007 / ORA; estimate of the change in extent, e.g. approximately 33% / a third; details of the change in extent, e.g. the East Siberian Sea is ice-free in summer 2007;	**2**
1(a)(ii)	*Award one mark for identifying the overall trend. Award one mark for further detail or use of data.* trend shows an increasing summer melt area of the Greenland ice sheet / average melt area is increasing; use of data to provide evidence for the increasing trend, e.g. the difference between summer 1979 and summer 2007 shows an increase in melt area of 16.5 million km^2; there are fluctuations / variations in the area melted, with some summers lower / higher than others;	**2**

Question	Answer	Marks
1(a)(iii)	*Maximum of 3 marks if there is no specific change to the water store or reference to only one water store.* rise in temperature causes; increased melting of ice; will cause a reduced volume / percentage / store of ice; of freshwater; reference to further reduced extent of the Arctic Ocean ice cap in Fig. 1.1; rise in sea level; due to (increased) melting of ice sheet / glaciers; results in an increased volume / percentage / store of water in the seas / oceans; of saline water; reference to further increased melt area of the Greenland ice sheet in Fig.1.2; reference to seas in Fig. 1.1; increased volume of sea water due to thermal expansion of sea water; *Credit ref. to correct changes in other water stores.* *Max. 4 marks if no reference to Fig. 1.1 or Fig. 1.2.*	**5**

Question	Answer	Marks
1(b)(i)	description of data on closures, e.g. by comparing 1983–1998 with 1999–2014: fewer years with no closures in 1999–2014; 5 years have no closures at all for 1983–1998, compared to only 1 year with no closures in 1999–2014; more closures in total between 1999–2014 than 1983–1998; increasing number of years with more than one closure in 1999–2014 than in 1983–1998; increasing number of closures per year; e.g., more than 10 in 2001, 2003, 2007 and 2014; 2014 has 48 in one year / highest value; 29 more than any other year; *Credit similar use of data where the graph is split into different sections.*	**3**

Question	Answer	Marks
1(b)(ii)	example of other barrages; advantages: reduced risk of flooding (of low-lying land); ref. to land less than 5 metres in Fig. 1.3; protection of urban area; reference to Greater London area in Fig. 1.3; protection of properties, e.g. businesses / homes; protection of infrastructure; protection of freshwater supply; disadvantages: cost to build; maintenance cost; environmental concerns; aesthetic concerns; disruption to water transport; increasing number of closures required causes more (frequent) disruption, as shown in Fig. 1.4; closure is hard to predict, as shown in Fig. 1.4; could cause flooding of other areas; ref. to land areas in Fig.1.3 to east / west of Thames Barrier; may be ineffective with continuing sea-level rise; *Max. 6 marks if no ref. to Fig. 1.3 or Fig. 1.4.* *Credit other suggestions. Credit other examples of barrages.* *Max. 5 marks for advantages or disadvantages alone.*	**8**

Question	Answer	Marks
2(a)(i)	a (gradual) change in the species / community; over time; from a pioneer community; (seral) stages in between; until a climax community is reached; reference to Fig. 2.1, e.g. lava is colonised by lichen, then different species become established, e.g. ferns, and eventually a mixed woodland is established;	**2**
2(a)(ii)	biomass increases during succession (and plateaus at climax); explanation: availability of minerals for plant growth; from decomposition of organic matter; number / density of plants increase; size of plants increase; increased primary productivity; larger proportion of plant becomes woody material with an increased biomass store; biodiversity is low (in the pioneer community / initially) and becomes higher / peaks and then reduces slightly; explanation: bare lava is a hostile environment / no soil (in the pioneer community); few species can exist; the environment becomes less hostile / more favourable; more species colonise; increasingly complex food web; the availability of habitats / niches increases;	**6**

Question	Answer	Marks
2(a)(iii)	more photosynthesis (per unit area); there is greater proportion of the biomass photosynthesising compared to the climax community / in the climax community more of the plant contains (non-photosynthetic biomass) woody material; less competition; for light;	**2**
2(b)(i)	lava of different ages; so different timescales for soil formation (leads to different stages of succession); lava has resulted in a new succession beginning; reference to human activity, e.g. agricultural activity; resulting in arrested succession; wildfire; fire destroys the woody biomass; succession is reverted to an earlier stage of the succession; *Accept other valid suggestions, e.g. difference in fertility.*	**2**

Question	Answer	Marks
2(b)(ii)	the preservation of fauna, flora, geomorphological structures and landscape / owtte; different habitats and lava of different ages, e.g. mixed woodland; the promotion of education and research; tour guides; monitoring of the environment; national park visitor centre; educational trail; information in the visitor centre; the restriction of harmful activities; boundary of the national park; separates the area from the pressures of human activity in surrounding urban area; control of access / gates; restricted access / tracks for vehicles; the promotion of recreational activities; tourism facilities; recreation trails taking visitors around specific areas and routes, around habitats, geological and geomorphological formations; the promotion of traditional agricultural activities and sustaining local livelihoods; traditional agricultural land use; vineyards and orchards; economic benefits, e.g. employment / tourism; *Max. of 6 marks if no ref. to Fig. 2.3.* *Award one mark for a role of a national park and up to two marks for an elaboration of the role, which may use information from Fig. 2.3 as indicated.* *Accept other valid statements.*	**8**

Question	Answer	Marks
Section B		
3(a)	A description of the regional differences in supply may refer to a plentiful supply of fresh water in Asia and South America, compared with lower volumes of fresh water in other regions such as Europe and Oceania. However, the proportion of fresh water available as run-off compared to the total volume of fresh water should be identified as being highest in North America and Asia, and lowest in Africa. In some regions run-off is significantly less than loss due to evaporation. Supporting data from Fig. 3.1 may reference, for example, more than 10 000 km^3 available as run-off in South America and Asia, compared to less in Europe and Oceania. However, of the total volume in North America 18 280 km^3, of which 8180, 45% is available as run-off. Although Africa has a total of 22 300 km^3 of fresh water, only 4600, 20% is available as run-off, a greater proportion, approx. 80% is lost in evaporation. Suggested reasons may refer to higher annual temperatures resulting in higher evaporation rates, reducing the availability of water as surface run-off. There may be reference to the relative sizes of the regions and to other climatic factors, for example precipitation and the seasonal variation in availability of precipitation, e.g. a short monsoon season. Variation in the distribution of freshwater resources and access to water supply within regions may be considered. **Please use level descriptors 1**	**10**

Question	Answer	Marks
3(b)	*The question requirements are:* • *to consider an increasing demand for water in examples of countries at different levels of economic development* • *to describe ways of meeting an increasing demand* • *to assess the impact of a growing demand upon natural water supplies.* **Indicative content:** There is an increased demand for water as a result of population growth and the need for access to freshwater supplies and increased sanitation. Intensive agriculture has expanded with an increasing demand for water for irrigation. Industrial development and energy requirements have also increased demand for water. A variety of ways of meeting demand can be considered, for example, building reservoirs and dams, use of pipelines, desalination, the use of deep wells, water treatment, the recycling of water and water conservation. The impact of a growing demand upon natural water supplies can be assessed. Examples could consider the diminishing water supplies as a result of pollution of surface water sources and groundwater. The overextraction of surface water and groundwater and the salinisation of freshwater supplies. **Please use level descriptors 2**	**30**

Question	Answer	Marks
4(a)	High diversity is found in the areas near to the Equator, in the central equatorial regions. Low diversity is found in the polar regions and central continental areas. There is a high biodiversity, indicated by a high density of plant species of over 1501 in the regions of South and central America, Africa and Southern Europe and Asia. The lowest biodiversity, as indicated by a low density of less than 100, is found in the polar regions the Arctic and Antarctic and in Northern Africa, and central Asia. A low biodiversity of less than 200 is found in northern parts of Europe, Canada and Russia and central Australia. This pattern relates to the global distribution of the major biomes. These may be used to describe the distribution, for example high diversity in the tropical rainforest and monsoon rainforest, low diversity in the high-latitude tundra and desert areas, and a middle range of diversity in the savannah. The distribution is determined by factors such as temperature and precipitation. Biomes with favourable conditions, e.g. high temperatures and precipitation throughout the year as found in the tropical rainforest, have high primary productivity, energy flow and nutrient availability. Biomes with hostile conditions, e.g. arid environments with low rainfall have low productivity. Other explanations may refer to other factors, e.g. soils or altitude. **Please use level descriptors 1**	**10**

Question	Answer	Marks
4(b)	*The question requirements are:* • *to consider methods of ecosystem management* • *to assess the extent to which these methods are effective in maintaining biodiversity* • *to consider factors other than ecosystem management that influence the ecosystem.* **Indicative content:** Methods used in ecosystem management to maintain biodiversity include conservation strategies through, for example, the creation of national parks or forest reserves or pollution control. The restoration of ecosystems through, for example, the re-introduction of species or the removal of invasive species and through preservation, for example, ecological islands, nature reserves and zoos. An assessment of the extent may consider where human activity has impacted upon the ecosystem, for example, by deforestation and agricultural land use but effective conservation is being practised, through sustainable agriculture and forestry. Alternatively, where anthropogenic factors have impacted to a large extent, but conservation is ineffective in maintaining biodiversity. There may be a consideration of the effect of natural factors on biodiversity beyond of the control of ecosystem management, e.g. drought and wildfires. **Please use level descriptors 2**	**30**

Question	Answer	Marks
5(a)	Run-off and discharge into the river from the agricultural, residential and urbanised areas contains pollutants, e.g. fertilisers, detergents and sewage. The increased nutrient levels, e.g. nitrogen and phosphorus compounds, in the water results in eutrophication. Increased nutrient levels in the water cause enhanced growth of algae, which forms an algal bloom. The algae die, and sink to the bottom. There is an increase in decomposers using oxygen in the water for respiration. As the layer of salt water is denser than fresh water, the bottom layer is not mixed with the water above, or with oxygen from the air. Consequently, the water becomes a 'dead zone' due to a depleted oxygen concentration resulting in the death of fish and other aquatic organisms. **Please use level descriptors 1**	**10**

Question	Answer	Marks
5(b)	*The question requirements are:* • *to consider sources of pollution of marine environments* • *to consider management strategies for reducing pollution of marine environments when the pollution originates from the land and from the sea* • *to evaluate the management strategies.* **Indicative content:** There should be reference to the land-based sources of pollution, for example both point and non-point sources may be considered, and organic and inorganic examples, e.g. sewage, fertilisers and metals. Marine sources of pollution should also be covered, e.g. dumping of waste or oil spills. Management strategies to reduce the sources of pollution from land can include, for example, timing of fertiliser treatment on agricultural land, water treatment, recycling of potential pollutants. Management strategies to reduce the sources of pollution from the sea may include shipping restrictions and exclusion zones or legislation on the dumping of waste at sea, double-hulled tankers etc. An evaluation of the management strategies may consider, for example, the difficulty in identifying the source of the pollution or in controlling marine pollution due to the effects of the pollution occurring some distance from the original source. **Please use level descriptors 2**	**30**

Section B descriptor levels:

Descriptor	Award Mark
Consistently meets the level criteria	Mark at top of level
Meets the criteria, but with some inconsistency	Middle, mark to just below top mark
Meets most of level criteria, but not all convincingly	Just below middle, mark to just above bottom mark
On the borderline of this level and the one below	Mark at bottom of level

Section B descriptor levels:

level descriptors 1

Level one, 8–10 marks
The response:
- contains few errors
- shows a very good understanding of the question
- shows a good use of data or the information provided, where appropriate
- provides a balanced answer

Level two, 5–7 marks
The response:
- may contain some errors
- shows an adequate understanding of the question
- shows some use of data or the information provided, where appropriate
- may lack balance

Level three, 1–4 marks
The response:
- may contain errors
- shows limited understanding of the question
- shows little or no use of data or the information, where appropriate
- lacks balance

Section B descriptor levels:

level descriptors 2

Responses:

Level one, 25–30 marks
- fulfil all the requirements of the question
- contain a very good understanding of the content required
- contain a very good balance of content
- contain substantial critical and supportive evaluations
- make accurate use of relevant vocabulary

Level two, 19–24 marks
- fulfil most of the requirements of the question
- contain a good understanding of the content required
- contain a good balance of content
- contain some critical and supportive evaluations
- make good use of relevant vocabulary

Level three, 13–18 marks
- fulfil some requirements of the question
- contain some understanding of the content required
- may contain some limited balance of content
- may contain brief evaluations
- make some use of relevant vocabulary

Level four, 6–12 marks
- fulfil limited requirements of the question
- contain limited understanding of the content required
- may contain poor balanced of content
- may not contain evaluations
- make limited use of relevant vocabulary

Section B descriptor levels:
Level five, 1–5 marks • fulfil a few requirements of the question • contain a very limited understanding of the content required • are likely to be unbalanced and undeveloped • evaluative statements are likely to be missing • make no use of relevant vocabulary