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**ENVIRONMENTAL MANAGEMENT**

**8291/22**

Paper 2

**October/November 2018**

MARK SCHEME

Maximum Mark: 80

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**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 International will not enter into discussions about these mark schemes.

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This document consists of **18** printed pages.

**PUBLISHED****Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)(i)	rural groundwater;	<b>1</b>
1(a)(ii)	<p><i>compounds:</i> (decomposing) organic matter / nitrogen oxides / NO<sub>x</sub> / phosphates / nitrates / ammonium compounds;</p> <p><i>sources:</i> <i>(decomposing) organic matter:</i> waste material from streets; waste disposal sites;</p> <p><i>nitrogen oxides / NO<sub>x</sub>:</i> air pollutants; from cars / industry; dissolved in precipitation / rainfall;</p> <p><i>phosphates:</i> e.g. detergents; domestic sources / street cleaning / car washing;</p> <p><i>nitrates:</i> from <b>garden</b> fertilisers;</p> <p><i>ammonium compounds:</i> septic tanks / untreated sewage; storm drainage;</p>	<b>max 3</b>
1(a)(iii)	(Total % of nitrogen compounds 11.8, total % of phosphorous compounds 27.8) / 27.8 – 11.8; 16;	<b>2</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)(iv)	<p>non-point source of pollution, from a large area;</p> <p>rainfall/precipitation falls on the land ; water is infiltrated into soil;</p> <p>nutrients from e.g. (inorganic) fertiliser / (organic) manure; are dissolved in soil water;</p> <p>some nutrients not absorbed by the forest / cropland / pasture;</p> <p>leaching; percolation / seep to water table / groundwater; groundwater flow to lake;</p>	<b>max 4</b>
1(b)	<p>eutrophication;</p> <p><i>reference to algal bloom in Fig. 1.1:</i> increased / excessive growth of algae or plants;</p> <p>(algae bloom) blocks out light for underwater plants below; (underwater) plants cannot photosynthesise;</p> <p>resulting in death and decay of algae or plants; increase in population of microorganisms or decomposers or bacteria;</p> <p>oxygen used in respiration; oxygen depletion of water;</p> <p>reduced biodiversity; death of aquatic organisms;</p>	<b>max 6</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(c)	reduce pollutants in run-off into water store e.g. reduce pollution from sewage / reduce agricultural run-off; improve waste disposal systems; water treatment / tertiary treatment; re-use of grey water / recycling of water; control of agricultural run-off through e.g. timing of fertiliser application or quantity of fertiliser; buffer strips; legislation to reduce industrial sources; fines for polluters; monitoring of nutrient levels in run-off; measuring of water quality variables in water stores; e.g. oxygen concentration, BOD, biotic index;	<b>max 4</b>

Question	Answer	Marks
2(a)(i)	high latitude; northern hemisphere; within Arctic Circle; surrounding the Arctic Ocean;	<b>max 2</b>
2(a)(ii)	climate; low average temperatures (–20 to 15); low average rainfall (less than 70 mm);  soil; permafrost / permanently frozen soil layer; bare rocky areas / limited soil;  vegetation; limiting factors for growth / productivity; vegetation is restricted to grasses, mosses, lichens, dwarf shrubs / low growing plants; treeless plains;  latitude; effect on day length / insolation;  ocean currents;	<b>max 4</b>
2(a)(iii)	populations are very low in some areas; less than 200 in Area 12 and Area 8 (Lancaster Sound / Kane Basin); populations are declining in 6 / 50% / examples of areas); a population range of less than 2000 in areas where the populations are declining; even in areas where the population is stable the range is only 1000–3000; there are only a few, areas where the population is currently increasing; population change and population numbers are unknown for large areas;	<b>max 4</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(b)	<p>increase in population of polar bear prey; e.g. bearded seal;</p> <p>increased availability of food for other predators; e.g. ringed seal;</p> <p>increase in population of other predators; reduced competition; e.g. Arctic fox ;</p>	<b>max 4</b>
2(c)	<p>agreements / treaties are required in order to manage the environment; different nations must share a collective responsibility for the biosphere including the tundra biome; other countries can have an effect on the tundra not just those in the immediate region; problems originate in the industrialised nations far away from where the effects are felt;</p> <p>e.g. air pollution – greenhouse gases; resulting in global warming / rising temperatures; resulting in earlier spring melting / shrinking of sea ice; habitat loss for polar bear;</p> <p>e.g. marine pollution – due to shipping; oil pollution; ocean currents spread maritime pollution; impact on food web;</p>	<b>max 6</b>



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Question	Answer	Marks
3(a)	<p>Most desalination, over 50% (53.4%), occurs in the arid areas of the Middle East. These areas have water scarcity, a limited availability of freshwater from surface water and depleted groundwater stores. On average, only 500 cubic metres of freshwater is available per person per year.</p> <p>All other regions collectively account for only 46.6%, of desalination. These regions have on average more freshwater available per person per year, from 1000 to 13 401 cubic metres.</p> <p>Regions with abundant water resources and low population density require minimal desalination for example South America with only 0.6% of desalination, as freshwater availability of 7200 cubic metres per person per year, is the second highest of all regions.</p> <p>Regions with a high population density and a high water demand for domestic supply and agriculture, have on average less freshwater available per person and more desalination for example Asia with 2970 cubic metres per person per year and 10.6% desalination.</p> <p>Less economically developed countries have a minimal supply of water from desalination, for example Sub-Saharan Africa with only 6.2% of desalination even though this region has the second lowest freshwater availability, after the Middle East.</p> <p>Although North America has the highest water freshwater availability of 13 401 cubic metres per person per year, it has the second highest amount of desalination 17%, due to a high demand for water for intensive agriculture, using irrigation.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p><b>please use level descriptors 1</b></p> </div>	<b>10</b>

Question	Answer	Marks
3(b)	<p><i>The question requirements are:</i></p> <ul style="list-style-type: none"><li><i>to outline one process of desalination</i></li><li><i>to discuss the advantages of desalination</i></li><li><i>to discuss the disadvantages of desalination.</i></li></ul> <p><b>Indicative content:</b></p> <p>Methods of desalination include for example electro dialysis, reverse osmosis, freezing and distillation.</p> <p>Advantages include the provision of potable water and reduced salt content of water. Desalination allows the use of brackish borehole water and the treatment of industrial and sewage effluents or polluted river water for reuse.</p> <p>Disadvantages include power consumption, the ecological impact of brine disposal, effectiveness of the process on a large scale and cost implications.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"><b>please use level descriptors 2</b></div>	<b>30</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)	<p>Overall there is a greater decrease in forest reserves.</p> <p>Europe has the largest forest area in 2010 and also the largest increase, with a gain of 20 000 thousand hectares between 1990 and 2010. Although in 1990, Asia has the second lowest area of forest of all the regions with only 580 000 thousand hectares; Asia has increased forest cover between 2000 and 2010 by 10 000 thousand hectares.</p> <p>Decreases in forest area have occurred in S. America and Africa. These regions had the second and third highest area of forest cover of 940 000 thousand hectares and 750 000 thousand hectares in 1990. The largest decrease occurred in S. America with a loss of 80 000 thousand hectares in 20 years. Africa lost 60 000 thousand hectares with the largest decrease occurring between 1990 and 2000.</p> <p>There was increasing forest cover in North America cover between 1990 and 2000 but since then forest cover has remained constant at 670 000 thousand hectares.</p> <p>Exploitation of forests, the unsustainable harvesting of forest wood resources or use of forests for fuel wood contributes to the decrease in forest area. Rapid population growth with forests cleared to provide land for agricultural use, commercial cattle farming, plantations and urbanisation as well as building of infrastructure, dams, mining and climate change can also account for losses.</p> <p>Reasons for increases may include the conservation of the forest resources, forest restoration and afforestation. The more sustainable use of forest resources, alternative uses of forests for example in ecotourism, the establishment of protected areas and international agreements have also contributed to increases in forest cover.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p><b>please use level descriptors 1</b></p> </div>	<b>10</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(b)	<p><i>The question requirements are:</i></p> <ul style="list-style-type: none"><li><i>to consider the conservation of a named ecosystem</i></li><li><i>to detail the strategies</i></li><li><i>to assess the effectiveness of the strategies.</i></li></ul> <p><b>Indicative content:</b></p> <p>Content will be dependent upon the chosen example, e.g. a coral reef ecosystem or a forest ecosystem.</p> <p>Assessment should consider the extent to which the strategies have been effective in conserving the ecosystem or whether strategies have been ineffectual due to other factors which can impact upon the ecosystem.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"><b>please use level descriptors 2</b></div>	<b>30</b>

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Question	Answer	Marks
5(a)	<p>Overall increases in water demand are predicted for both BRICS and LEDCs while in MEDCs an overall decrease in demand is predicted.</p> <p>Increases in water demand are predicted in the electricity sector in both BRICS and LEDCs.</p> <p>The demand for water in both domestic and manufacturing industry sectors is expected to increase in all groups of countries but with greater increases in BRICS and LEDCs.</p> <p>There is a predicted overall decrease in water demand in the agricultural sector in both MEDCs and BRICS.</p> <p>Economic development and industrialisation in BRICS and LEDCs will result in increased demand in electricity and manufacturing sectors. These competing demands for water will leave little scope for water for irrigation. Thus the agricultural sector will have less water and while irrigation use in agriculture is still the largest use of water, a decreasing demand for water for agriculture is predicted due to water scarcity and decreasing supplies.</p> <p>The reduced demand for water in MEDCs may develop from the sustainable use of water, water conservation, the recycling of water, metering of water or legislation.</p> <p>Increasing population in BRIC's and LEDCs increases the demand for a domestic supply so that overall domestic demand is expected to increase.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p><b>please use level descriptors 1</b></p> </div>	<b>10</b>

Question	Answer	Marks
5(b)	<p><i>The question requirements are:</i></p> <ul style="list-style-type: none"> <li><i>to use examples of different countries to consider population growth and the growing demand for water</i></li> <li><i>to assess the impact on quality of natural water supplies</i></li> <li><i>to assess the impact on quantity of natural water supplies.</i></li> </ul> <p><b>Indicative content:</b></p> <p>Population is expected to reach 10 billion by 2050 and overall water demand will increase by a third, mostly in the economically developing countries.</p> <p>There is growing demand for water with economic development which will continue to increase demand in domestic and industrial sectors. More water is required for energy.</p> <p>This will impact on the quality of water. Increased domestic use will generate more waste water and more industry, manufacturing and power generation will produce more pollutants resulting in increased water pollution. Increased agricultural output will be required to feed an increasing global population, resulting in the increased use of fertilisers and more eutrophication.</p> <p>Increased water demand will impact upon the quantity of water. The increased extraction from rivers, and groundwater stores will deplete water resources. For example the overuse of wells for irrigation water will deplete groundwater stores.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p><b>please use level descriptors 2</b></p> </div>	<b>30</b>

**Section B descriptor levels:**

<b>Descriptor</b>	<b>Award Mark</b>
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:****Section B (part a)****Level descriptors 1****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

**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

**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:****Section B (part b):****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 poorly 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 of the 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