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**ENVIRONMENTAL MANAGEMENT**

**8291/21**

Paper 2

**May/June 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.

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**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.

**PUBLISHED****Section A**

Question	Answer	Marks
1(a)(i)	73%;	<b>1</b>
1(a)(ii)	(mass of) living / biotic / organic (components of the ecosystem) (per unit area / ecosystem); mass of living organisms, in a given area, measured in grams per square metre;	<b>1</b>
1(a)(iii)	nutrients are recycled in the ecosystem;  (inorganic compounds / nutrients) from the soil are absorbed by plant roots into the plant; assimilation (into organic compounds) / (secondary) productivity; growth; stored as wood / new biomass;  dead leaves / dead organisms / leaf fall are incorporated into leaf litter;  leaf litter is broken down / decays; due to the action of detritivores / microbial action; humus formation; nutrients are released into the soil store as (inorganic compounds / minerals) soil is enriched;	<b>3</b>

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Question	Answer	Marks
1(a)(iv)	<p><i>precipitation outputs:</i> run-off, removes nutrients (dissolved in precipitation); leaching removes nutrients from the soil store by; percolation to groundwater;</p> <p><i>precipitation inputs:</i> nutrients, dissolved in rainfall; e.g. nitrite; throughfall / interception / leaf drip / stem flow; infiltration of rainwater into soil store;</p> <p>nutrients dissolved in solution; allows the uptake of nutrients by plants; by diffusion / active transport;</p> <p>used in plant growth and stored in biomass; (chemical weathering) of bedrock releases nutrients into the soil store;</p>	<b>4</b>
1(a)(v)	<p>rapid rate of decomposition of (organic material); due to increased rate of microbial activity;</p> <p>high temperature and high humidity / rainfall provide optimum conditions for this (rapid decomposition);</p> <p>rapid incorporation of nutrients into humus;</p> <p>rapid recycling of nutrients / nutrients spend a relatively short time period in litter and soil;</p> <p>longevity / nutrients are incorporated by organisms over a long period of time in growth;</p>	<b>3</b>

Question	Answer	Marks
1(b)(i)	<p>removal of the biomass;  <b>increased</b> surface run-off;  <b>increased</b> nutrient loss from soil store;  <b>increased</b> leaching of soil;  soil erosion / soil degradation;</p> <p>the destruction of the vegetation results in loss of habitat;  loss of food supply;  loss of nesting and breeding sites for the community of organisms;  declining populations;  biodiversity loss / species are vulnerable / threatened / at risk of extinction;</p> <p>effect on climate / hydrological cycle, e.g. ;  a change in rates of evaporation / evapotranspiration;  a change in precipitation rate;  risk of flooding;</p> <p>subsistence agriculture has the highest percentage use (45%) but has less effect on the nutrient cycles;  the ecosystem can be restored through natural succession;  only small fragmented areas are used;  nutrients are replenished through nutrient recycling;  the effect of logging (10%) will be dependent on the type of logging / area of land involved;</p> <p>cattle ranching (20%) / plantation (20%) have greater effect due to removal of biomass <b>from large areas</b>;  overgrazing;  soil compaction by trampling;</p> <p>pasture land has less effect on nutrient cycles, as the ground is covered with vegetation and soil cover is maintained (compared to plantation where the soil is part exposed during the growing season) / and manure is added;</p> <p>although the lowest percentage of deforestation (5%) is from the ‘others’ category, e.g. mining, dams, these have a greater effect due to complete removal of biomass and soil pollution;</p>	5

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(b)(ii)	<p>sustainable agriculture in conservation areas;  e.g. agroforestry which combines using the land for growing a suitable crop within the forest thus maintaining the forest;  use crop rotation;</p> <p>subsistence agriculture using small fragmented areas with sufficient time for natural succession;</p> <p>sustainable use of forest resources;  selective logging in timber managed areas;  removing some trees from forest while maintaining the overall forest as opposed to clear cutting large areas;  preventing the illegal logging of specific species;</p> <p>afforestation;  of fragmented forest areas;  re-growing the forest;</p> <p>protected areas / protected forest reserves;  national parks;</p> <p>restricting impact of human activity by, e.g. ;  raising awareness through education of the economic value of and benefits of maintaining forest cover and its associated wildlife;  ecotourism;</p>	<b>3</b>

Question	Answer	Marks
2(a)(i)	a low-lying area / close to sea level;  glacier melt (coincides with); monsoon rainfall / increased precipitation in wet season;  <b>increased</b> input of water / river flow / volume / discharge;  increase surface run-off; from higher land;  reduce infiltration of soil; soil saturation; high water table;  less interception in agricultural land due to reduced forest cover;	<b>4</b>



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Question	Answer	Marks
2(a)(ii)	<p><i>environment:</i>            increase in temperature;  <b>increased</b> melting of glaciers;  <b>increased</b> river flow into delta;</p> <p>thermal expansion of sea water;            rise in sea level;  <b>increased</b> inundation of delta/increased tidal surge;</p> <p><b>long-term</b> flooding of delta region;</p> <p>salt water intrusion;            reduced freshwater stores in river, lake, wetland;            salinization of soil;</p> <p>change in hydrological cycle;            e.g. increase in storm / frequency / intensity; increased length of dry season;</p> <p><i>population:</i>            effect drinking water supply;</p> <p>effect on rain-fed irrigation;            effect on the suitability of land for growing crops;            effect on agricultural output of delta;</p> <p>loss of livelihood;            migration of population inland;</p> <p>ecological effects;</p>	<b>6</b>

Question	Answer	Marks
2(b)(i)	<p>reservoir stores water during heavy rain / water from glacier melt; for drinking water / domestic use; use in industry;</p> <p>provides a water supply during the dry season; irrigation water for agriculture; extends the growing season ;</p> <p>hydroelectric power generation; electricity supply for cities, e.g. Vientiane;</p> <p>flood protection; control of river flow to lower course of river reducing frequency of downstream flooding;</p> <p>economic value of dams; tourism opportunities; employment opportunities provided by dam building projects;</p> <p>recreation activities; e.g. sailing, fishing;</p>	<b>4</b>

Question	Answer	Marks
2(b)(ii)	<p>effect on the natural flow of water, rate of flow; reduced flow of water to <b>lower</b> course of river;</p> <p>transport of sediments downstream is effected by the build-up of sediment in the dam; reduced supply of nutrients downstream/ reduces soil fertility of farmland in the lower course of the river;</p> <p>effect on agricultural activity; reduced supply of water for rain-fed irrigation; e.g. rice-growing in Mekong Delta;</p> <p>lowering of water table; destruction of wetlands; ecological disruption / effect on freshwater species;</p> <p>effect on freshwater lakes; e.g. reduced supply of water to (Tonle Sap) lake; effect on freshwater fisheries; loss of livelihood for people dependent on the fisheries;</p> <p>increased salinization of delta region;</p> <p>effect on ecosystems destroyed by dam-building; deforestation; dust and noise during dam building; forced displacement of people evicted from their lands and homes;</p>	<b>6</b>

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Question	Answer	Marks
3(a)	<p>A decreasing trend is shown in the number of oil spills from tankers in each decade (245, 93, 77 and 35 oil spills). The largest decrease occurred between the 1970s and 1980s with a decrease of 152 spills subsequently followed by a slowing in the rate of decrease. The number of oil spills was six times greater between 1970–79 to, compared to 2000–09.</p> <p>Suggested reasons for the changes may include reference to changes in shipping regulations; changes in the size and the design of ships for oil transportation or to an overall reduction in the transport of oil, linked to decreasing demand and the use of alternative fuel and energy resources.</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-top: 10px;"><b>Please use level descriptors 1</b></div>	<b>10</b>
3(b)	<p><i>The question requirements are:</i></p> <ul style="list-style-type: none"> <li><i>to describe the main sources of pollution other than oil spills</i></li> <li><i>to use examples of the management of marine pollution</i></li> <li><i>to explain to what extent marine pollution can be managed by individual countries</i></li> </ul> <p><b>Indicative content:</b></p> <p>Sources of marine pollution include, for example, sewage; agricultural run-off; industrial wastewater; natural sources; drainage of coastal ecosystems; deforestation; dredging and urban development.</p> <p>Reference can be made to the management of marine pollution by individual countries through examples of laws or policies; the management of waste; changes in agricultural practices; coastal ecosystem restoration; shipping regulations; the establishment of protected areas; pollution controls; as well as education, awareness and research. For example pollution of the Great Barrier Reef is effectively managed through the establishment of a marine park and zoning plan.</p> <p>An assessment may consider that as sources of pollution occur some distance from their effect and cross international borders, for example air pollution or due to maritime transportation which together, with the dispersal of marine pollutants make management difficult. Environmental management resulting from international management plans may be more effective, for example, UNEP’s Regional Seas Program.</p> <div style="border: 1px solid black; padding: 2px; 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>The meaning of an ecological island should be described through the use of examples. An island separated from the mainland and surrounded by sea as shown in Fig.4.1.</p> <p>A small habitat surrounded by different environmental conditions and different habitats e.g. a small pond in woodland. An ecological island can be natural or man-made.</p> <p>Man-made ecological islands e.g. a park in a city, or the ecological island created by building a pest proof fence as shown in Fig. 4.1.</p> <p>Other examples include wildlife parks or game reserves.</p> <p>Essentially an ecological island is an area that contains species that cannot mix with other populations of the species.</p> <p>An ecological island offers a range of conservation benefits. They can ensure the survival of vulnerable species by reducing competition for food or other resources or by excluding predation.</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-top: 10px;"><b>Please use level descriptors 1</b></div>	<b>10</b>

Question	Answer	Marks
4(b)	<p><i>The question requirements are:</i></p> <p><i>to discuss methods of conservation which exclude human activity</i></p> <p><i>to discuss methods of conservation which involve human activity</i></p> <p><i>to use examples</i></p> <p><b>Indicative content:</b></p> <p>Conservation methods range from strict nature reserves, isolated ecological islands and protected areas with complete exclusion of human activity. Some areas allow access though permit only or for research purposes.</p> <p>Other less strict reserves will allow ecotourism and educational visits but other forms of human activity are banned.</p> <p>National parks allow open access to visitors and recreational activities.</p> <p>Managed resource areas allow the sustainable use of resources within conservation areas with traditional forms of agriculture and forestry.</p> <p>An assessment should consider whether the preservation of species, habitats or ecosystems is more effective, if humans are excluded.</p> <p>An alternative perspective may consider that conservation is more successful when human activity is involved; either through direct intervention in the conservation of the species or with community involvement. Conservation is valued and considered important from an economic perspective, e.g. for ecotourism. The effectiveness of the methods used with reference to criteria such as education, research opportunities, public awareness, economic value and sustainability should be considered.</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;"><b>Please use level descriptors 2</b></div>	<b>30</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)	<p>Changes in the percentage annual growth rate of the global population should be described with reference to an overall increase between 1920 and 1970 and an overall decrease between 1970 and 2015. Variation in the overall rates of increase and decrease during these periods should be considered.</p> <p>Increasing percentage annual growth rate can be attributed to reasons such as increased birth rates, a reduction in the rate of infant mortality, medical improvements and incentives to have larger families.</p> <p>Slower periods of growth rate at can be attributed to significant periods of war, disease or famine.</p> <p>Reasons for a decreasing percentage annual global growth rate can include reference to family planning, the increased use of contraceptives, and population policies. Continuing decreasing growth rate can be linked to economic and social development.</p> <div data-bbox="349 655 808 707" style="border: 1px solid black; padding: 2px;"><b>Please use level descriptors 1</b></div>	<b>10</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(b)	<p><i>The question requirements are:</i></p> <p><i>to use contrasting examples</i></p> <p><i>to describe the impact of population change on resources</i></p> <p><b>Indicative content:</b></p> <p>An answer may consider issues arising from an increasing global population, with overpopulation negatively impacting on global resources. Demand for food is expected to continue to grow due to the rising global population. Increased crop and meat production and increasingly more biofuels will be required. This will increase pressure on land resources. Expansion of farmland into areas less suitable for agriculture will require greater use of irrigation and fertilisers. More irrigation will impact on the quantity of water; the use of fertilisers will result in more water pollution. More and more of the natural environment will be used and destroyed e.g. deforestation of the tropical rainforest for agriculture will result in soil degradation. A growing population will also require land for housing and industry as well as agriculture.</p> <p>Alternatively a decreasing percentage annual growth rate of the global population may eventually lead to equilibrium and optimum population size. A fairer distribution of resources, the sustainable use of resources and protection of resources with less impact upon global resources.</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;"><b>Please use level descriptors 2</b></div>	<b>30</b>



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Question	Answer	Marks										
	<p style="text-align: center;"><b>Section B descriptor levels:</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th data-bbox="524 284 1137 331">Descriptor</th> <th data-bbox="1137 284 1751 331">Award Mark</th> </tr> </thead> <tbody> <tr> <td data-bbox="524 331 1137 384">Consistently meets the level criteria</td> <td data-bbox="1137 331 1751 384">Mark at top of level</td> </tr> <tr> <td data-bbox="524 384 1137 469">Meets the criteria, but with some inconsistency</td> <td data-bbox="1137 384 1751 469">Middle, mark to just below top mark</td> </tr> <tr> <td data-bbox="524 469 1137 553">Meets most of level criteria, but not all convincingly</td> <td data-bbox="1137 469 1751 553">Just below middle, mark to just above bottom mark</td> </tr> <tr> <td data-bbox="524 553 1137 636">On the borderline of this level and the one below</td> <td data-bbox="1137 553 1751 636">Mark at bottom of level</td> </tr> </tbody> </table> <p><b>Section B (part a),</b></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: 20px;"><b>Level descriptors 1</b></div> <p><b>8–10 marks</b> 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</p> <p><b>5–7 marks</b> 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</p>	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	
Descriptor	Award Mark											
Consistently meets the level criteria	Mark at top of level											
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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											

Question	Answer	Marks
	<p><b>1–4 marks</b> The response: may contains errors shows limited understanding of the question shows little or no use of data or the information, where appropriate lacks balance</p> <p><b>Section B (part b):</b></p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 10px 0;"><b>Level descriptors 2</b></div> <p>Responses:</p> <p><b>Level one, 25–30 marks</b> 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</p> <p><b>Level two, 19–24 marks</b> 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</p> <p><b>Level three, 13–18 marks</b> 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</p>	

Question	Answer	Marks
	<p><b>Level four, 6–12 marks</b> fulfil limited requirements of the question contain limited understanding of the content required may contain poor balance of content may not contain evaluations make limited use of relevant vocabulary</p> <p><b>Level five, 1–5 marks</b> 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</p>	