Cambridge Assessment International Education

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT **8291/01**

Paper 1 Principles of Environmental Management **For examination from 2022**

MARK SCHEME

Maximum Mark: 80

Specimen

This document has **18** pages. Blank pages are indicated.

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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must **Allow** for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	<u>'List rule' guidance</u> (see examples below) For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided • Any response marked *ignore* in the mark scheme should not count towards ***n*** • Incorrect responses should not be awarded credit but will still count towards ***n*** • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6	Calculation specific guidance Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'. For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values. For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme. Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.
7	Guidance for chemical equations Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme. State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same marking point
AW	alternative wording (where responses vary more than usual)
max	indicates the maximum number of marks that can be given
ORA	or reverse argument
ECF	error carried forward
I	ignore

Examples of how to apply the list rule

State **three** reasons ... [3]

A

1. Correct	✓	**2**
2. Correct	✓	
3. Wrong	×	

B (4 responses)

1. Correct, Correct	✓, ✓	**3**
2. Correct	✓	
3. Wrong	ignore	

C (4 responses)

1. Correct	✓	**2**
2. Correct, Wrong	✓, ×	
3. Correct	ignore	

D (4 responses)

1. Correct	✓	**2**
2. Correct, CON (of 2.)	×, (discount 2)	
3. Correct	✓	

E (4 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct, Wrong	✓	

F (4 responses)

1. Correct	✓	**2**
2. Correct	✓	
3. Correct CON (of 3.)	× (discount 3)	

G (5 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct Correct CON (of 4.)	✓ ignore ignore	

H (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. CON (of 2.) Correct	(discount 2) ✓	

I (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. Correct CON (of 2.)	✓ (discount 2)	

Section A

Question	Answer	Marks	Guidance
1(a)(i)	717.9 (people km^{-2}); answer given to 1 decimal place;	**2**	**Allow**: 717.897 **Allow**: 717.7
1(a)(ii)	4.49; answer given to 3 significant figures;	**2**	**Allow**: 4.49(26)
1(a)(iii)	Bangladesh large(r) increase in population density / Italy small(er) increase in population density; relevant data; *max. three from:* increased migration into the country; growth in industry requiring increased workforce; refugees moving into country; availability of health care; role of women; education opportunities available for women; availability of contraception;	**4**	
1(b)(i)	*any two from:* higher percentage of population over 80; lower percentage of population under 29; higher percentage of population in the middle age groups;	**2**	
1(b)(ii)	*any three from:* lower tax revenues; higher pension spending; pressure on health care; pressure to raise retirement age;	**3**	**Allow**: ECF from **1(b)(i)**

Question	Answer	Marks	Guidance
2(a)	*any four from:* reduces food waste; run on garden waste / available fuel for farmers / no need to use fossil fuels; food has a longer shelf life; longer time to reach market; catalytic converter reduces emissions of oxides of nitrogen; can work all year round; increased revenue;	**4**	
2(b)	*max. two from each benefit:* (feeding livestock) reduce need to grow animal feed; reduce pressure on agricultural land; (compost) improves soil; reduces need for fertilisers; (renewable energy) use as a biofuel; reduces dependency on fossil fuels; reduces greenhouse gas emissions; carbon neutral; increase stability of fuel costs; (disposal) reduces demands on landfill site; reduces costs of waste management;	**4**	

Question	Answer	Marks	Guidance
2(c)	*any two from:* population growth; unsustainable production; price setting; land degradation; agricultural disease; diverting crops for biofuels; climate change; water shortages; poverty;	**2**	

Question	Answer	Marks	Guidance
3(a)(i)	long-term energy security: supply of energy that is in line with economic developments and environmental needs; short-term energy security: systems that react promptly to sudden changes in the supply-demand balance;	**2**	
3(a)(ii)	*any four from:* disrupted electricity supply; increasing prices for energy resources; increasing costs for industry; job losses / economic recession; increased levels of poverty / low standards of living; reliance on imported sources of energy; civil disruption / conflict;	**4**	

Question	Answer	Marks	Guidance
3(b)	*max. four from positive impact:* X will have improved productivity for industries; X will reduce reliance on imported fuels; Y / Z can import electricity to use in own industries; Y / Z can sell building materials to X; *max. four from negative impact:* X will experience high building or installation costs; X will need to pay to relocate any flooded villages; X will experience variable output of the new dam due to seasonal change; Y / Z will experience a reduced electrical output for downstream dams; Y / Z will experience a reduced water supply, which may reduce industrial activity;	**6**	

Question	Answer	Marks	Guidance
4(a)(i)	producer at the base; primary consumer followed by a secondary consumer;	**2**	organisms must be from the same food chain
4(a)(ii)	amount of biomass reduces at each trophic level; energy is transferred as heat (to surroundings); (due to processes such as) respiration / excretion / movement / reproduction / death;	**3**	
4(b)(i)	rate of production of biomass;	**1**	
4(b)(ii)	*any one from:* availability of light; ambient temperature; soil compaction; erosion of soil; leaching of nutrients;	**1**	

Question	Answer	Marks	Guidance
4(c)(i)	*max. three from description of techniques:* sustainable harvesting; vanilla crop can be grown as a vine on a host tree; wide range of crops; crop rotation; use of compost and manure; tree planting; *explanation of how techniques manage impacts:* (sustainable harvesting means) low percentage of cultivated land within rainforest; (vanilla crop on host tree) prevents trees being cut down; (trees not being cut down) prevents damage to soil structure; (trees not being cut down) maintains the habitat for native birds/monkeys; (wide range of crops) extends growing season; (crop rotation) maintains mineral content of soil / prevents mineral depletion in soil; (use of compost and manure) improves structure of soil; (tree planting) improves soil structure as roots bind soil;	**6**	max. 3 marks for simple list of techniques from Fig. 4.2 explanation must be linked to relevant technique
4(c)(ii)	*any three from:* limited light available; chloroplasts cannot harvest enough energy; limits rate of photosynthesis; limited water availability; competition for nutrients;	**3**	

Question	Answer	Marks	Guidance
5(a)	chlorofluorocarbons (CFCs) are unreactive compounds / are not broken down (in the troposphere); CFCs break down in the presence of ultraviolet light; a chlorine atom is released; (rapid) reactions between chlorine atoms and ozone; breaks down ozone (O_3) to oxygen (O_2); chlorine atoms remain in the stratosphere / continue to destroy ozone;	**4**	
5(b)	some of the auxiliary hypotheses were not backed up by experimental evidence / the behaviour of CFCs in laboratories was that they were very stable;	**1**	

Question	Answer	Marks	Guidance
5(c)	*any two from:* cataracts / skin cancer; decreased crop yields; loss of biodiversity (of terrestrial and aquatic ecosystems); degradation of materials (used in clothing and construction);	**2**	
5(d)	*any two from:* long-term effects not known when new products accepted to be used; cost to the economy when products are banned and replaced by alternatives; monitoring of industry to ensure rules are followed; conflicting scientific reports and interpretation of data and models; need for international agreement;	**2**	

Section B

Mark levels for Question 6 and Question 7

This question assesses AO2 and AO3 skills. Award a mark for each AO separately. The mark awarded will be the total of the marks awarded for AO2 and AO3. Marks should be awarded based on a judgement of the overall quality of the response for that AO, rather than awarding marks for specific points.

Indicative content is provided as a guide. Inevitably, the mark scheme cannot cover all responses that candidates may make for all of the questions. In some cases candidates may make some responses which the mark scheme has not predicted. These answers should nevertheless be credited according to their quality.

Instructions for using the levels

Start from the top level for each AO and read down until you meet the level that 'best fits' the response. An answer needs to show evidence of most, but not necessarily **all**, of the qualities described in a level. Use the following guide to decide which mark to give within the level.

Description of candidate response	**Award mark**
Consistently meets the level criteria	Mark at top of level
Meets most of criteria but with some inconsistency	Mark at middle of level
On the borderline of this level and the one below	Mark at bottom of level

Award a mark for each AO separately. Then add the two marks together to arrive at the total mark for the response.

Indicative content

Question	Answer	Marks	Guidance
6	**'National parks are an effective method of conserving biodiversity.'** **To what extent do you agree with this statement?** **Give reasons and include information from relevant examples to support your answer.** The question requirements are to: • show an awareness of the role of national parks • describe how national parks conserve and / or create habitats • use local, national or global examples of other methods of conserving biodiversity • give a balanced argument about whether national parks are an effective way to conserve biodiversity • reach a conclusion that is based on qualitative and / or quantitative information. This question assesses AO2 and AO3 skills. **Indicative content** Candidates may refer to planning / building restrictions, protection from exploitation, limiting access and tourism, role of rangers, education, conservation, public awareness, political lobbying, government funding, scientific research, setting land aside. They may go on to describe how these result in the conservation of habitats. Candidates may use specific examples of national parks / case studies. Candidates may consider that within a national park the biodiversity is protected but how does the conservation extend beyond the national park when migration occurs or pollution results from sources outside the park? International differences in the meaning of the term national park may also be considered. Candidates may refer to conservation zones, other types of protected areas, captive breeding and release programmes, protection of species (CITES, IWC, EU CFP, ITTO, IUCN), regulation of sustainable harvesting, EDGE, rewilding, debt for nature swaps. The wide range of strategies will all have limitations that may be outlined by candidates. They may consider: the challenges in applying international guidelines and restrictions; challenges in monitoring conservation behaviour worldwide; differences in culture and lifestyle; the challenge of funding projects in countries where there are high levels of poverty.	**20**	

Question	Answer	Marks	Guidance
6	Candidates are likely to agree that national parks are an effective method of conserving biodiversity, but must be used in conjunction with other described methods to conserve biodiversity to its fullest extent. Answers should be supported by case studies / relevant examples where national parks have been very successful in maintaining and promoting biodiversity, and also those which have suffered from human and natural threats (forest fires, poachers, urban development). Candidates may also consider that the threat of climate change on biodiversity is so great that a national park would not be able to protect animals, plants and their habitats from its effects.		

Question	Answer	Marks	Guidance
7	**Evaluate the success of strategies to manage water security in a location of your choice.** **Give reasons and include information from relevant examples to support your answer.** The question requirements are to: • show an awareness of the importance of water security • describe the strategies used for managing water security • use a local, national or global example • give a balanced argument as to the success of the strategies • reach a conclusion that is based on qualitative and / or quantitative information. This question assesses AO2 and AO3 skills. **Indicative content** Candidates may describe the issue of water security. Candidates may refer to a number of different strategies for managing water security. Candidates may illustrate each strategy with a case study / the success or otherwise in the location they have chosen. Candidates may describe whether strategies used have improved water security and whether they have caused environmental, social or economic problems. When considering sustainable water extraction and improved supply, the main challenge is likely to be the cost of large-scale engineering projects and how projects may have a negative impact on the rest of the drainage basin. If dams or reservoirs are planned this may reduce water supply downstream and may prevent flow of sediment, changes to the ecosystem may affect biodiversity. Any pipes and pumps added would have associated cost and access to remote sites may make maintenance difficult. Reducing water usage in a country may be difficult if the population is growing and the demands for domestic, agricultural and industrial water use are increasing, it may be expensive to source the seeds for crops that demand less water, recycling water would need infrastructure and there may be social resistance to using grey water.	**20**	

Question	Answer	Marks	Guidance
7	Other methods that may be discussed are improving education by schooling, or government programmes. Rationing may be suggested, but if the population is getting a limited supply of water this may be difficult to reduce. However, there may be some industries using substantial amounts of water, for example, golf courses or ornamental gardens, where their water supply could be rationed. Climate change may be reducing the amount of water available to ration, however, if there is an increase in precipitation at part of the year careful management may be used to store this water. International agreements and guidelines may support countries in planning their water management but it would be very difficult to enforce rules and to monitor water use across international borders. Candidates may provide a balance to these challenges by arguing that water security must be managed using a range of strategies to prevent water insecurity. Water insecurity may cause crop failure, livestock death, famine and illness. Candidates may then evaluate the strategies for their chosen location. Candidates may suggest that by using a range of strategies a more sustainable water supply will result. For example, if dams are to be built, to build a series of smaller dams to help surrounding population rather than individual large dams that cause significant change to the drainage basin; methods of managing flood plains to slow the flow of water and allow infiltration into the soil to recharge aquifers; begin a programme of tree planting between crops to increase vegetation interception; invest in some new crops that are more drought-resistant, and over time increase the use of drought-resistant crops; consider irrigation methods, such as drip irrigation to reduce evaporation from areas of open water. By using a range of strategies, the challenges associated are reduced as the engineering projects are not so large or the rationing not so restrictive.		

Generic levels of response

Level	AO2: Information handling and analysis	Marks
3	• Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic. • Incorporates frequent use of directly relevant examples.	7–8
2	• Responses contain explanations with some gaps or errors in the reasoning. • Explanations may lack detail or accurate knowledge. • Examples are included but some opportunities to include relevant examples are missed.	4–6
1	• Responses contain a few general points, which are mainly descriptive, comprising a few simple points. • Knowledge is basic and understanding may be poor and lack relevance to the question set. • Irrelevant or no examples are given.	1–3
0	• No creditable response.	0

Level	AO3: Investigation skills and making judgements	Marks
4	• Clearly presents and develops both sides of the argument. • Judgements are fully supported with relevant qualitative and/or quantitative information. • Clear, balanced conclusion which is consistent with the question and candidate response.	10–12
3	• One side of the argument is better developed than the other. • Judgements are partially supported with qualitative and/or quantitative information. • Conclusion is consistent with the question and candidate response.	7–9
2	• Describes only one side of the argument. • Judgements have minimal support; qualitative or quantitative information lacks relevance. • Conclusion may be inconsistent with the question and candidate response.	4–6
1	• Response is descriptive. • Minimal judgement is made, unsupported by qualitative or quantitative information. • Conclusion is inconsistent with the question and candidate response, or no conclusion made.	1–3
0	• No creditable response.	0

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