



# Cambridge International AS Level

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**ENVIRONMENTAL MANAGEMENT**

**8291/12**

Paper 1 Principles of Environmental Management

**May/June 2023**

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.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

**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.

**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 'List rule' guidance

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.

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)	the ability to meet the needs of the present; without compromising the ability of future generations to meet their own needs;	<b>2</b>
1(b)(i)	<p><i>any three from:</i></p> <p><i>max 2 from 1800–2022:</i></p> <p>from 1800–1950 slow / steady increase; after 1925 increases more rapidly; data quote;</p> <p><i>max 2 from 2022–2100:</i></p> <p>after 2022 increases; but at a slower rate / slower increase; data quote;</p>	<b>3</b>
1(b)(ii)	<p><i>any three from:</i></p> <p>availability / access to contraception; education about contraception / how to use contraception / family planning; education and opportunities for women; financial incentives for having smaller families / anti-natalist policies;</p>	<b>3</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(c)(i)	<p><i>any three from:</i></p> <p>Italy has a narrow base whereas Kenya has a wide base;</p> <p>Italy has a bulge 40–59 whereas Kenya gradually decreases each year group / Italy has a barrel shape whereas Kenya has a pyramid shape;</p> <p>Italy has a more aged population than Kenya / Italy has more people in over 80 categories than Kenya;</p> <p>both countries have even proportions of males and females in each age category;</p> <p>comparative data quote e.g. 2% in Italy and 6.7% in Kenya for 0–4 yrs;</p>	<b>3</b>
1(c)(ii)	<p><i>any four from:</i></p> <p><i>Italy:</i>  better healthcare;  better social care;  more food secure / water secure;  more migration (immigration) for better opportunities / named reason;</p> <p><i>Kenya:</i>  more conflict;  more infectious diseases;  poorer sanitation;  more migration (emigration);  high infant mortality;</p> <p>Italy is a HIC and Kenya is a MIC/LIC / are at different economic levels;</p> <p>ORA for all points</p>	<b>4</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(i)	<p><i>any four from:</i></p> <p>fossil fuel depletion;</p> <p>inequality in (global) energy resources;</p> <p>population growth;</p> <p>differing energy needs of countries in different income groups / LICs may not be able to afford investment in renewable energy resources;</p> <p>climate change;</p> <p>supply disruption / natural disasters / piracy / terrorism / conflict or war;</p>	<b>4</b>
2(a)(ii)	<p><i>any three from:</i></p> <p>lower reliance on fossil fuels;</p> <p>produce less, pollution / carbon dioxide;</p> <p>aim for carbon neutral / achieve emission targets / Paris agreement;</p> <p>produce income;</p> <p>flooding prevention / regulate flow of water;</p> <p>stored body of water to reduce water insecurity;</p> <p>irrigation in agriculture (back-up supply);</p> <p>improved, road / communications;</p> <p>helps balance supply and demand of electricity;</p> <p>creates job opportunities;</p>	<b>3</b>
2(a)(iii)	biofuel / biomass / bioethanol / biogas / geothermal / tidal energy / wave energy / solar energy / wind energy;	<b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(b)(i)	<p><i>any four from:</i></p> <ul style="list-style-type: none"> <li>captive breeding and release;</li> <li>habitat conservation / protected areas;</li> <li>ban on fishing;</li> <li>make them protected species;</li> <li>educate people;</li> <li>ecotourism;</li> </ul>	<b>4</b>
2(b)(ii)	<p><i>any three from:</i></p> <ul style="list-style-type: none"> <li>implement protection / guide actions to conserve endangered species;</li> <li>education / raise awareness;</li> <li>inventory to classify / keep track of species;</li> <li>inform decision makers / influence policy makers;</li> <li>make available information about endangered species and risk of extinction;</li> <li>support scientific research;</li> </ul>	<b>3</b>



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(c)	<p><i>any four from:</i>  more than 1 million people displaced / families forced to move;    many towns and villages lost / historic sites lost;    loss of habitats / change in the ecosystems / land was deforested;    loss of land for food production / increased food insecurity;    change in river flow downstream;    prevents navigation of the river;    change in water quality / water not suitable for use;    possible risk of earthquakes;    economic reasons / high cost of building dam / need to borrow large amount of money to build;</p>	<b>4</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)	<p><i>any five from:</i>  waste from manufacturing;  enters ground water / rivers / lakes;    taken up by plants / incorporated into plant tissues / taken up by fish / incorporated into fish tissues;  eaten by primary / secondary consumers;  eaten by humans;    bioaccumulation;  biomagnification;    PDBEs are volatile so could be inhaled directly;</p>	<b>5</b>

Question	Answer	Marks
3(b)(i)	<p><i>any four from:</i> dispersion in ocean reduces concentration to much lower amounts / reduces risk;</p> <p>PDBEs would need to be removed from fabrics; PDBEs are volatile so removal is complex;</p> <p>removal / disposal, may be very costly;</p> <p>disposal at sea requires, plastics / metal containers;</p> <p>long-term effects not known;</p> <p>(disposal at sea) not an option for many countries;</p>	<b>4</b>
3(b)(ii)	<p><i>any three from:</i> develop alternative flame retardants;</p> <p>recycling of materials containing PDBEs;</p> <p>treat waste water containing PDBEs;</p> <p>monitor levels in different foods;</p> <p>laws to control its use and disposal; complete ban on their use;</p> <p>incineration;</p>	<b>3</b>
3(c)	<p><i>agree:</i> salmon does have the lowest mean concentration;</p> <p><i>disagree:</i> sample size, too small / not significant;</p>	<b>1</b>

Question	Answer	Marks
4(a)(i)	<p><i>any two from:</i> uses technology; large amount of data; collected rapidly; computer analysis;</p>	<b>2</b>
4(a)(ii)	<p><i>any three from:</i> minerals are underground so surveying is complex; potential sites still have to be surveyed manually;</p> <p>people can rely too heavily on the data; computer analysis not perfect / data may not be reliable;</p> <p>limited human input;</p>	<b>3</b>
4(b)(i)	<p><i>any five from:</i> <i>max 3 from positives:</i> brings income to local communities / provides jobs;</p> <p>provides infrastructure;</p> <p>generates tax for government / raising countries GDP; funds healthcare / social care;</p> <p><i>max 3 from negatives:</i> damage to lake bed habitat (caused by moving large amounts of sediment); most plants and animals die;</p> <p>food chain disrupted; releases minerals that can enter food chain;</p> <p>water no longer, drinkable / usable by humans / water insecurity; water cannot be used for irrigation / food insecurity;</p>	<b>5</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(b)(ii)	<i>any three from:</i> leaving reserves for future generations;  process materials more efficiently;  quotas for extraction;  controlled extraction by local communities;	<b>3</b>

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Question	Answer	Marks
5	<p><b>‘Reducing deforestation, increasing reforestation and afforestation are effective strategies for reducing the impact of climate change.’</b></p> <p><b>To what extent do you agree with this statement?</b></p> <p><b>Give reasons and include information from relevant examples to support your answer.</b></p> <p>The question requirements are to:</p> <ul style="list-style-type: none"> <li>• show an understanding of climate change</li> <li>• describe the processes of deforestation, reforestation and afforestation</li> <li>• explain how the strategies limit climate change</li> <li>• evaluate the statement</li> </ul> <p>This question assesses AO2 and AO3 skills.</p> <p><b>Indicative content</b></p> <p>Candidates may refer to photosynthesis and carbon capture by trees, release of carbon stored when trees are felled, more emissions being released as trees release stored carbon when they rot / burn on forest floor.</p> <p>Candidates may use specific examples of individual, local, national and international schemes, including case studies e.g. bans on deforestation, reforestation / tree planting projects, afforestation / establishment of forests.</p> <p>The wide range of schemes will all have limitations that may be outlined by candidates.</p> <p>Candidates are likely to have mixed opinions about the effectiveness but their answer should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.</p>	20

Question	Answer		Marks	
5	<b>Generic levels of response</b>			
	<b>Level</b>	<b>AO2: Information handling and analysis</b>	<b>Marks</b>	
	3	<ul style="list-style-type: none"> <li>• Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic.</li> <li>• Incorporates frequent use of directly relevant examples.</li> </ul>	<b>7–8</b>	
	2	<ul style="list-style-type: none"> <li>• Responses contain explanations with some gaps or errors in the reasoning.</li> <li>• Explanations may lack detail or accurate knowledge.</li> <li>• Examples are included but some opportunities to include relevant examples are missed.</li> </ul>	<b>4–6</b>	
	1	<ul style="list-style-type: none"> <li>• Responses contain a few general points, which are mainly descriptive, comprising a few simple points,</li> <li>• Knowledge is basic and understanding may be poor and lack relevance to the question set.</li> <li>• Irrelevant or no examples are given.</li> </ul>	<b>1–3</b>	
0	<ul style="list-style-type: none"> <li>• No creditable response.</li> </ul>	<b>0</b>		

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<b>Question</b>	<b>Answer</b>			<b>Marks</b>
5	<b>Level</b>	<b>AO3: Investigation skills and making judgements</b>	<b>Marks</b>	
	4	<ul style="list-style-type: none"> <li>• Clearly presents and develops both sides of the argument.</li> <li>• Judgements are fully supported with relevant qualitative and / or quantitative information</li> <li>• Clear balanced conclusion which is consistent with the question and candidate response.</li> </ul>	<b>10–12</b>	
	3	<ul style="list-style-type: none"> <li>• One side of the argument is better developed than the other.</li> <li>• Judgements are partially supported with qualitative and / or quantitative information</li> <li>• Conclusion is consistent with the question and candidate response.</li> </ul>	<b>7–9</b>	
	2	<ul style="list-style-type: none"> <li>• Describes only one side of the argument.</li> <li>• Judgements have minimal support; qualitative or quantitative information lacks relevance.</li> <li>• Conclusion may be inconsistent with the question and candidate response.</li> </ul>	<b>4–6</b>	
	1	<ul style="list-style-type: none"> <li>• Response is descriptive.</li> <li>• Minimal judgement is made, unsupported by qualitative or quantitative information,</li> <li>• Conclusion is inconsistent with the question and candidate response, or no conclusion made,</li> </ul>	<b>1–3</b>	
	0	<ul style="list-style-type: none"> <li>• No creditable response</li> </ul>	<b>0</b>	

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6	<p><b>Evaluate the success of strategies for managing water security.</b></p> <p><b>Give reasons and include information from relevant examples to support your answer.</b></p> <p>The question requirements are to:</p> <ul style="list-style-type: none"> <li>• show an understanding of the importance of water security</li> <li>• describe strategies for improving water security</li> <li>• describe successful and less successful examples</li> <li>• evaluate the statement on an individual, local, national and global level</li> </ul> <p>This question assesses AO2 and AO3 skills.</p> <p><b>Indicative content</b></p> <p>Candidates may provide a definition of water security in terms of sufficient quantities of clean water to maintain adequate standards of food and manufacturing of goods, adequate sanitation and sustainable health care.</p> <p>Strategies for improving water security may include: reducing / banning deforestation, reforestation / afforestation projects, wetland restoration, mangrove restoration, preservation of flood plains, water management / protection of water supplies, prevention / reducing water pollution, agricultural water management e.g. water-efficient crop varieties / irrigation techniques, education on sustainable use of water and recycling / use of grey water.</p> <p>Candidates may use specific examples of individual, local, national and international strategies, including case studies. The examples should be balanced and show successful and less successful methods.</p> <p>Candidates may describe the limitations of the methods.</p> <p>Candidates are likely to be split over their conclusion but their answer should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.</p>	20



Question	Answer		Marks
6	<b>Generic levels of response</b>		
	<b>Level</b>	<b>AO2: Information handling and analysis</b>	<b>Marks</b>
	3	<ul style="list-style-type: none"> <li>• Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic.</li> <li>• Incorporates frequent use of directly relevant examples.</li> </ul>	<b>7–8</b>
	2	<ul style="list-style-type: none"> <li>• Responses contain explanations with some gaps or errors in the reasoning.</li> <li>• Explanations may lack detail or accurate knowledge.</li> <li>• Examples are included but some opportunities to include relevant examples are missed.</li> </ul>	<b>4–6</b>
	1	<ul style="list-style-type: none"> <li>• Responses contain a few general points, which are mainly descriptive, comprising a few simple points,</li> <li>• Knowledge is basic and understanding may be poor and lack relevance to the question set.</li> <li>• Irrelevant or no examples are given.</li> </ul>	<b>1–3</b>
	0	<ul style="list-style-type: none"> <li>• No creditable response.</li> </ul>	<b>0</b>

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Question	Answer			Marks
6	<b>Level</b>	<b>AO3: Investigation skills and making judgements</b>	<b>Marks</b>	
	4	<ul style="list-style-type: none"> <li>• Clearly presents and develops both sides of the argument.</li> <li>• Judgements are fully supported with relevant qualitative and / or quantitative information</li> <li>• Clear balanced conclusion which is consistent with the question and candidate response.</li> </ul>	<b>10–12</b>	
	3	<ul style="list-style-type: none"> <li>• One side of the argument is better developed than the other.</li> <li>• Judgements are partially supported with qualitative and / or quantitative information</li> <li>• Conclusion is consistent with the question and candidate response.</li> </ul>	<b>7–9</b>	
	2	<ul style="list-style-type: none"> <li>• Describes only one side of the argument.</li> <li>• Judgements have minimal support; qualitative or quantitative information lacks relevance.</li> <li>• Conclusion may be inconsistent with the question and candidate response.</li> </ul>	<b>4–6</b>	
	1	<ul style="list-style-type: none"> <li>• Response is descriptive.</li> <li>• Minimal judgement is made, unsupported by qualitative or quantitative information,</li> <li>• Conclusion is inconsistent with the question and candidate response, or no conclusion made,</li> </ul>	<b>1–3</b>	
	0	<ul style="list-style-type: none"> <li>• No creditable response</li> </ul>	<b>0</b>	