CAMBRIDGE
International Education

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT **8291/12**

Paper 1 Principles of Environmental Management **October/November 2025**

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 International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level 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 descriptions 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> 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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

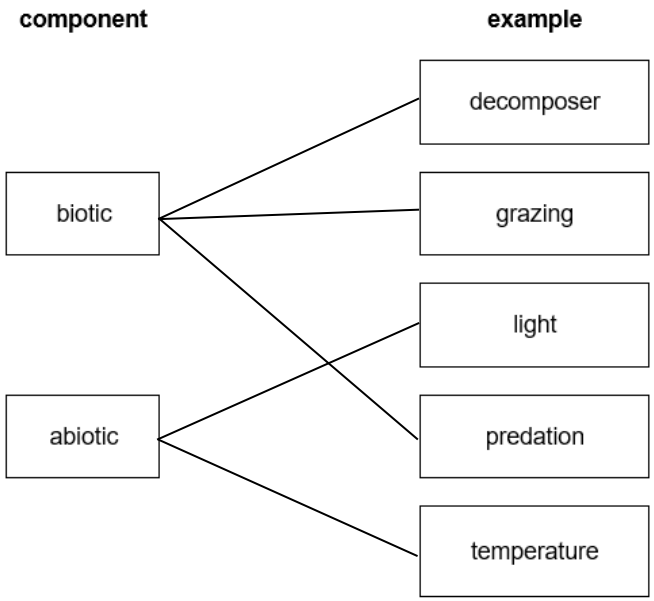
We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
BOD	benefit of the doubt given
TV	response is too vague or there is insufficient detail in response
ECF	error carried forward applied
^	information missing or insufficient for credit
I	incorrect or insufficient point ignored while marking the rest of the response
R	incorrect point or mark not awarded
LNK	two statements are linked
SEEN	point has been noted, but no credit has been given or blank page seen

Annotation	Meaning
	key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
	blank page
	Assessment Objective (AO), number corresponds to AO**1**, AO**2** etc.
	Level of Response. Number indicates the level awarded to the response (mark scheme details mark ranges for each level)
	correct awarding one mark from marking point or marking group 1. similar numbered ticks are used for marking point or marking groups 2, 3, 4 etc.
	response has not answered question
	contradiction in response, mark not awarded

Question	Answer	Marks
1(a)(i)	**M1** idea of a community (or organisms) / mixture of species; **M2** interacting with their environment / interaction between biotic and abiotic factors;	**2**
1(a)(ii)	*any four from:* **M1** inter-specific; **M2** between different species / between trees and shrubs; **M3** intra-specific; **M4** between same species / between conifers or any named species;	**4**
1(b)(i)	**M1** biotic joined to decomposer **and** grazing **and** predation; **M2** abiotic joined to light **and** temperature;  	**2**

Question	Answer	Marks
1(b)(ii)	*any four from:* **M1** light needed for photosynthesis; **M2** less light energy captured by chlorophyll; **M3** less synthesis of glucose; **M4** less, glucose available for growth / respiration / energy; **M5** less, substances made / seed production / biomass / crop yield / primary productivity; AVP;	**4**
1(b)(iii)	*any two from:* **M1** thin out the conifers; **M2** harvest some of the mature trees; **M3** remove dead trees; **M4** plant less densely; **M5** plant different species of tree together;	**2**
1(c)	**M1** idea of separating one large forest into several smaller separate forests; *any two from:* **M2** separates populations of species; **M3** reduces gene flow / prevents organisms from breeding; **M4** changes biodiversity; **M5** changes migration; **M6** increases soil erosion; **M7** increases spread of disease; **M8** increases spread of invasive species; **M9** changes abiotic conditions in the forest;	**3**
2(a)(i)	*any three from:* **M1** both have lower % germination at pH 4 than pH 7 / ORA; **M2** pH has a greater effect on wheat / radish has higher % germination than wheat; **M3** at pH 7 radish is 100% but wheat is 90%; **M4** comparative data quote e.g. radish decreases by 10% whereas wheat decreases by 30%;	**3**

Question	Answer	Marks
2(a)(ii)	*any two from:* **M1** crop yield is reduced; **M2** less seeds germinate / less plants grow; **M3** causes defoliation; **M4** less photosynthesis;	**2**
2(b)	*any four from:* **M1** nitrogen from the atmosphere; **M2** reacts in high temperatures of vehicle engines; **M3** forms nitrogen monoxide; **M4** reacts with water **and** oxygen; **M5** to form nitric acid;	**4**
2(c)(i)	*benefit (max 1):* **M1** helps reduce wet acid deposition; **M2** deemed fair / easily justified to the public; **M3** generates income to reinvest / to reduce pollution long term; *limitation (max 1)* **M4** difficult to apportion responsibility; **M5** requires management / difficult to enforce; **M6** costly to manage;	**2**
2(c)(ii)	*any two from:* **M1** reduced use of fossil fuels / more use of renewable energy sources; **M2** flue gas desulfurisation / use of scrubbers; **M3** catalytic converters; **M4** restrict vehicle use / transport policies; **M5** legislation;	**2**

Question	Answer	Marks
3(a)(i)	**M1 both** axes labelled including unit (million tonnes per year) on *y*-axis ; **M2** linear scale on both with data occupying at least half of the grid; **M3** all 5 points plotted to within ±half of a small square; **M4** straight line drawn between each data point;	**4**
3(a)(ii)	**M1** 0.49;;	**2**
3(b)(i)	*any four from:* **M1** removal of vegetation; **M2** habitat loss; **M3** disruption of food chain; **M4** migration of animals / animals scared away; **M5** loss of biodiversity / extinction; **M6** water pollution / air pollution / noise (pollution) / accumulation of toxic chemicals; **M7** soil degradation / compaction;	**4**
3(b)(ii)	*any two from:* **M1** produces compost that can be sold; **M2** reduces requirements for fertilisers / compost can be used as a fertiliser; **M3** reduces need for landfill; **M4** can also produce, biogas / methane / used as energy source;	**2**
3(b)(iii)	*any two from:* **M1** difficult to regulate nutrient balance in the feed; **M2** waste food has short shelf life; **M3** difficult to store; **M4** attracts, vermin / rats / flies; **M5** public reservations / ethical objections; **M6** unknown effects on food chain; **M7** food waste can be toxic / cause illness in animals;	**2**

Question	Answer	Marks
4(a)(i)	**M1** leg ring;	**1**
4(a)(ii)	*any three from:* **M1** deforestation / habitat loss; **M2** predation / named predator; **M3** hunting; **M4** disease; **M5** invasive species; **M6** genetic depletion / inbreeding; **M7** population limited to one location / risk of natural disaster; **M8** climate change / global warming; **M9** lack of food / prey;	**3**
4(b)	*any three from:* **M1** stop people from hunting / fishing / extract minerals / extract timber (from the reserve); **M2** reserve is managed to limit impact on kagu; **M3** people educated about the importance of kagu; **M4** eco-tourism developed; **M5** predators removed / invasive species controlled; AVP;	**3**
4(c)(i)	*any two from:* **M1** register of endangered species; **M2** regulates / controls, trade; **M3** globally recognised / most governments follow regulations / international agreement;	**2**
4(c)(ii)	*any three from:* **M1** most trade is illegal; **M2** large profit to be made; **M3** no other income for some people; **M4** the demand still exists; **M5** not all countries follow CITES regulations;	**3**

Question	Answer	Marks
4(d)	*any four from:* *benefits: (max 3)* **M1** can prevent extinction; **M2** healthy parents can be selected; **M3** parents from different locations / gene pools can be bred; **M4** breeding more successful than in the wild / produce more offspring than in the wild; **M5** offspring can be reintroduced into other locations / more suitable locations / reserves; **M6** allows (scientific) research / monitoring; **M7** promotes education; *limitations: (max 3)* **M8** small population to remove breeding adults from; **M9** small gene pool / risk of inbreeding; **M10** not all species breed in captivity; **M11** expensive; **M12** offspring may not, be adjusted to wild / survive / not breed successfully in the wild; **M13** can introduce disease;	**4**

Question	Answer	Marks
5	**'Using technology is the most effective method for data collection and analysis.'** The question requirements are to: • show an understanding of technological methods for collection and analysis • show an understanding of non-technology based methods • show an understanding of big data • outline benefits and limitations of technological methods • evaluate the statement with particular emphasis on 'the most effective method'. Candidates may describe technological methods for collection, including geospatial systems, satellite sensors, radio tracking, computer modelling and crowd sourcing, AI and automated computer-based analysis. Candidates may describe non-technology based methods including sampling techniques and manual mathematical analysis. Candidates may describe big data including its benefits and limitations. Candidates may describe benefits and limitations of technological methods, including ease of application, cost, availability, bias, species and habitat appropriateness. Candidates are likely to be split about the effectiveness of the strategy but their reasoning should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence. **Mark levels for Question 5** 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.	**20**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5</td><td>
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.

<table>
<tr><th>Level</th><th>AO2: Information handling and analysis</th><th>Marks</th></tr>
<tr><td>3</td><td>• Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic.
• Incorporates frequent use of directly relevant examples.</td><td>7–8</td></tr>
<tr><td>2</td><td>• 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.</td><td>4–6</td></tr>
<tr><td>1</td><td>• 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.</td><td>1–3</td></tr>
<tr><td>0</td><td>• No creditable response.</td><td>0</td></tr>
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<tr><th>Level</th><th>AO3: Investigation skills and making judgements</th><th>Marks</th></tr>
<tr><td>4</td><td>• 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.</td><td>10–12</td></tr>
<tr><td>3</td><td>• 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.</td><td>7–9</td></tr>
<tr><td>2</td><td>• 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.</td><td>4–6</td></tr>
<tr><td>1</td><td>• 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.</td><td>1–3</td></tr>
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Question	Answer	Marks
6	**Evaluate hydroelectric dams as a strategy for managing global energy security.** The question requirements are to: • show an understanding of energy insecurity including causes and impacts • describe hydroelectric electricity generation including its benefits and limitations • describe other methods of electricity generation including their benefits and limitations • evaluate the success of hydroelectric dam projects with particular emphasis on 'global energy security'. Candidates may describe the causes of energy insecurity, including population growth, climate change, fossil fuel depletion and reduced reliance, inequality in resources and supply disruption. Candidates may describe the impacts of energy insecurity, including disrupted supply, increased prices, increased reliance on imports, economic losses, job losses, poverty and conflict. Candidates may describe the method of hydroelectric energy generation, its benefits including largest source of renewable energy, guaranteed energy and price stability, storage of drinking water, stabilisation of energy grids, contribution to fighting climate change, and limitations including suitable geography, climate, land availability, finances, technology public support, unknown effects of climate change. Candidates may describe other methods of energy generation and their limitations including renewable and non-renewable sources. Candidates may use specific examples of hydroelectric dam projects. The examples should be balanced and show successful and less successful projects. Candidates are likely to conclude that the strategy is ineffective but their reasoning should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence. **Mark levels for Question 6** 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.	**20**

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but not necessarily all, of the qualities described in a level. Use the following guide to decide which mark to give within the level.
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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.

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<tr><td>4</td><td>• 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.</td><td>10–12</td></tr>
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