CAMBRIDGE
International Education

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT **8291/11**

Paper 1 Principles of Environmental Management **May/June 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 May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

 [Turn over

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	‘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.

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)	liquid to gas / vapour;	**1**
1(b)(i)	*any two from:* **MP1** prevents / blocks water from reaching the ground / soil; **MP2** reduces (rate of) infiltration / water absorbed by soil; **MP3** reduces (surface) run-off / throughflow / groundwater flow; **MP4** more / increases evaporation (from leaves); **MP5** allows fog / mist to condense / form; **MP6** less water stored as ground water / reduces aquifer recharge;	**2**
1(b)(ii)	infiltration ticked precipitation ticked surface run-off ticked ;; **3** correct ticks = **2 marks** **2** correct ticks = **1 mark**	**2**
1(c)(i)	the higher the income group, the greater the percentage of water withdrawn (from water sources by industry) / LICs withdraw a lower percentage of water than MICs / HICs;	**1**

Question	Answer	Marks
1(c)(ii)	**Either** *prediction:* **MP1** any **one** value from 12 to 70; *explanation:* **MP2** in between LIC and HIC values / greater than Rwanda but less than France; **OR** *prediction:* **MP3** any **one** value in the range 22–30; *explanation:* **MP4** in between the two MICs / China and Malaysia;	**2**
1(d)(i)	North America;	**1**
1(d)(ii)	*any three from:* **MP1** (continuous) permafrost around the pole / continuous permafrost closer to the North Pole; **MP2** discontinuous permafrost further away from the pole / on the outer edges of the continuous permafrost / discontinuous permafrost is further south; **MP3** more (continuous) permafrost in Asia (than North America); **MP4** less permafrost in Europe / Greenland; **MP5** some discontinuous permafrost in central Asia / away from the pole; **MP6** permafrost only on land areas / not in the oceans;	**3**

Question	Answer	Marks
1(d)(iii)	*any two from:* **MP1** overall area of permafrost decreases; **MP2** less continuous permafrost / bigger proportion of discontinuous permafrost; **MP3** correct use of key;	**2**
1(d)(iv)	**MP1** methane is a greenhouse gas / methane increases carbon in the atmosphere; **MP2** methane traps / absorbs IR / infrared / longwave radiation in the atmosphere; **MP3** enhanced greenhouse effect;	**3**

Question	Answer	Marks
2(a)(i)	**Due to an issue with question 2(a)(i), the question has been removed from the question paper.**	**6**
2(a)(ii)	**Due to an issue with question 2(a)(ii), the question has been removed from the question paper.**	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(i)</td><td>
MP1 N = 840;

MP2 one demonstration of correct calculation of n / N;

MP3 one demonstration of correct calculation of (n / N)²;

MP4 ∑(n / N)² = 0.29;

<table>
<tr><th>species</th><th>population / number of individuals n</th><th>n / N</th><th>(n / N)²</th></tr>
<tr><td>shiny star grass</td><td>35</td><td>0.0417</td><td>0.00174 / 0.002</td></tr>
<tr><td>butter gerbera</td><td>360</td><td>0.429</td><td>0.184</td></tr>
<tr><td>heartvine</td><td>95</td><td>0.113</td><td>0.013</td></tr>
<tr><td>sheepfig</td><td>230</td><td>0.274</td><td>0.075</td></tr>
<tr><td>hairy crabgrass</td><td>120</td><td>0.143</td><td>0.020</td></tr>
<tr><td></td><td>N = 840</td><td></td><td>∑(n/N)² = 0.29</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>2(b)(ii)</td><td>0.71;</td><td>1</td></tr>
<tr><td>2(b)(iii)</td><td>grassland is more (bio)diverse / tundra is less (bio)diverse;</td><td>1</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(iv)</td><td>
<table>
<tr><td></td><td colspan="2">biome</td></tr>
<tr><td></td><td>grassland</td><td>tundra</td></tr>
<tr><td>climate</td><td></td><td>MP1
cold and dry / low precipitation;</td></tr>
<tr><td>soil type</td><td>MP2
more fertile / deeper soils / with higher nutrients;</td><td></td></tr>
<tr><td>vegetation</td><td></td><td>MP3
idea of grasses, mosses, lichens and shrubs;</td></tr>
</table>
</td><td>3</td></tr>
</table>

Question	Answer	Marks
3(a)(i)	**MP1** 4497.94 **or** 28 517 000 ÷ 6340 seen; **MP2** 4498;	**2**
3(a)(ii)	*any three factors for difference in population density from:* *Beijing has more:* **MP1** economic opportunities / more jobs; **MP2** political advantages e.g. political stability; **MP3** historical ties / family links; **MP4** improved access to food / water; **MP5** geographical opportunities e.g. idea of available space / more land / more area; **MP6** availability of named resources e.g. better healthcare, affordable housing, education facilities; **MP7** it is the capital city;	**3**
3(b)(i)	China = 38 (years); Australia = (+) 0.5 (%);	**2**
3(b)(ii)	*any one from:* **MP1** as median age increases the percentage population change decreases; **MP2** (countries with) a low median age have an increasing population; **MP3** (countries with) a high median age have a decreasing population;	**1**

Question	Answer	Marks
3(c)	*any three from:* **MP1** birth rate; **MP2** reference to contraception / family planning / birth control; **MP3** population policies e.g. pro-natal / anti-natal policies; **MP4** death rate / mortality rate; **MP5** health care; **MP6** migration / immigration / emigration; **MP7** food / water (in)security; **MP8** war or conflict / natural disasters;	**3**
3(d)	*any three from:* **MP1** lower tax revenues / economy decreases; **MP2** lower number of people in workforce / not enough people to fill jobs; **MP3** higher pension spending; **MP4** increased cost of **/** pressure on health care / need for increase in health care / care of elderly e.g. care homes; **MP5** pressure to raise retirement age / higher retirement age; **MP6** idea of positive impact e.g. sharing their experience / able to provide (free) childcare;	**3**

Question	Answer	Marks
4(a)(i)	*any two from:* **MP1** bioethanol; **MP2** biogas; **MP3** wood;	**2**
4(a)(ii)	**MP1** idea that crop plants are continually planted / replanted / can be regrown / replenished; **MP2** not finite / won't run out;	**2**
4(a)(iii)	*any two from:* **MP1** increases energy security / low cost source of energy / more affordable than other energy sources; **MP2** reduces reliance on / use of fossil fuels; **MP3** can be grown carbon neutral; **MP4** takes in carbon dioxide / reduces atmospheric carbon dioxide / act as carbon sink; **MP5** generates income in rural communities; **MP6** can be grown sustainably / sustainable energy;	**2**

Question	Answer	Marks
4(a)(iv)	*any two from:* **MP1** it is a monoculture / monocrop; **MP2** outcompetes other plants / doesn't allow native plants to survive; **MP3** removes nutrients from soil / causes soil infertility; **MP4** reduces water availability; **MP5** changes the habitat for consumers / not suitable habitat for consumers / cannot be eaten by consumers / loss of food for consumers;	**2**
4(a)(v)	*any three from:* **MP1** biofuels are grown as a cash crop / for profit / for energy / biofuels are not grown for food / reduces amount of food grown; **MP2** land that could be used for food crops / animals is used to grow biofuels; **MP3** reduces diversity of food crops; **MP4** increases risk of disease impacting food crops; **MP5** increases cost of food crops / can lead to price setting; **MP6** increased reliance on imported food;	**3**
4(b)	2005–2010;	**1**

Question	Answer	Marks
5	The question requirements are to: • show an understanding of nuclear energy • describe the causes of energy insecurity • describe the impacts of energy insecurity • describe strategies for improving energy security • evaluate the statement with particular emphasis on 'the most effective strategy'. Candidates may describe renewable and non-renewable energy sources. Candidates may describe local and global impacts of energy insecurity including short-term and long-term impacts. Candidates may suggest that other strategies are more effective such as increasing renewables. 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.	**20**

Question	Answer	Marks
6	The question requirements are to: • show an understanding of the causes of air pollution • show an understanding of the impact of air pollution • describe successful and less successful strategies • evaluate the success of policies Candidates should describe the causes of air pollution including carbon dioxide, methane, carbon monoxide, oxides of nitrogen, sulfur dioxide, particulates and VOCs. Candidates should describe the impacts of air pollution including climate change, enhanced greenhouse effect, wet and dry acid deposition, smog, decreased crop yields, deterioration of plastics and rubber, harm to human health. Candidates may describe specific examples of individual, local, national and international strategies, including reduced use of fossil fuels, reduced emissions, flue gas desulfurisation, catalytic converters, transport policies, legislation, polluter pays principle. The examples should be balanced and show successful and less successful strategies. These examples may highlight the difference in success of strategies in LICs and HICs and explain the reasons for the difference. Candidates are likely to conclude that strategies are ineffective, but their reasoning should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.	**20**

Levels of response Question 5 and Question 6

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