CAMBRIDGE
International Education

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT **8291/13**

Paper 1 Principles of Environmental Management **May/June 2026**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **22** printed pages.

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[Turn over

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind.

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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.

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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.

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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

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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
	Repetition in response

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Mark Scheme Abbreviations

Abbreviation	Meaning
;	separates marking points
/	alternative responses for the same marking point
R	reject the response
A	accept the response
I	ignore the response
ecf	error carried forward
AVP	any valid point
ora	or reverse argument
AW	alternative wording
underline	actual word given must be used by candidate (grammatical variants excepted)
( )	the word / phrase in brackets is not required but sets the context
max	indicates the maximum number of marks that can be given
M1, **M2**….	marking point reference

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general guidance: *in general ignore the follow if unqualified:*

pollution

land pollution

death

harms or damages or impacts health

harms or damages or impacts the environment

not environmentally friendly

affects or impacts environment / people

standard of living

resources

accept *alternate wording throughout*

allow *development where stated*
underlined terms are specially required for the marking point, although accept phonetic spellings throughout guidance allow are extra marking points unless referenced to numbered marking point, e.g. M1 or qualified, e.g. **allow** CH_4 for methane

allow CO2 CO^2 Co2 co2

allow GHG / GG for greenhouse gases

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Question	Answer	Marks	Guidance
1(a)(i)	1;	**1**	
1(a)(ii)	**M1** 3 ground water flow; **M2** 4 through-flow;	**2**	**ignore** ground water unqualified for **process 3** **not** ground water <u>absorption</u> **not** infiltration for **process 4** **M2 accept** percolation
1(b)	**M1** increases process 7 / increases run-off; *any one from:* **M2** (grazing) reduces plants or foliage / removes leaves or roots / (livestock) feed on vegetation; **M3** reduces stability of soil / soil erosion; **M4** decreases interception;	**2**	**M1 accept** description of run-off, i.e., water flowing down the mountain

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(c)(i)</td><td>any four from:

M1 allows crops to be grown all year;

M2 requires less area for growth / requires less land / increases production per unit area / high yield / maximises crop yield;

M3 high growth rates / quicker production;

M4 produces better quality crops / can be automated to produce uniform crops;

M5 uses a low amount of water / less water is used / recycles water / limits water pollution;

M6 allows controlled / reduced use of, fertilisers or pesticides;

M7 low labour costs;

M8 can be grown indoors so not weather dependent / can control temperature or humidity or light;

M9 no soil needed / grown in liquid medium / nutrients provided in the water;

M10 less competition between plants;</td><td>4</td><td>use numbered ticks

ignore cost unqualified

M2 accept increases yield

M5 accept reduces water wastage

M6 reject fertilisers not needed / pesticides not needed
M6 accept less risk of pests and disease

M8 ignore grown indoors unqualified</td></tr>
<tr><td>1(c)(ii)</td><td>carbon dioxide + water → glucose + oxygen;</td><td>1</td><td>reject correctly balanced symbol equation</td></tr>
<tr><td>1(c)(iii)</td><td><table><tr><th>description</th><th>tick (✓)</th></tr><tr><td>it only occurs during the day</td><td></td></tr><tr><td>1 glucose molecule respired forms 6 carbon dioxide molecules</td><td>✓</td></tr><tr><td>6 oxygen molecules are needed to respire 1 molecule of glucose</td><td>✓</td></tr></table></td><td>2</td><td>Max 1 mark if all 3 ticked</td></tr>
</table>

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Question	Answer	Marks	Guidance
2(a)(i)	**M1** people per km^2; **M2** 218.5;	**2**	**M1 accept** people / km^2 or people km^{-2}
2(a)(ii)	*supports:* Argentina has the greater population / Greece has a lower population; *does not support:* Greece has the greater (population) density / Argentina has the lowest (population) density;	**2**	
2(b)(i)	*any three from:* **M1** more males overall; **M2** males and females are similar for range 0–19; **M3** more males in range 20–74; **M4** males and females are similar for, 75 and over; **M5** comparative data quote; e.g. 4 × more males 30–34 than females;	**3**	**ignore** birth rate / death rate **M1 accept** males total 72.1 **and** females total 27.4 **M4 accept** 65–79 years **M5 note** must be data manipulation **M5 accept** e.g. 3.6 × more males than females at ages 30–34 e.g. 2.6 × more males than females overall
2(b)(ii)	idea of migration / males enter country (for work);	**1**	**ignore** reasons why female numbers are lower, e.g. femicide **accept** immigration **reject** emigration of males

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Question	Answer	Marks	Guidance
2(c)	*any five from:* *LICs have a narrower top / less older people (max 3)* **M1** shorter life expectancy / higher death rate; **M2** poorer healthcare; **M3** poorer, nutrition / food sources / water availability; **M4** poorer sanitation; *LICs have a wider base / more younger people (max 3)* **M5** higher birth rate; **M6** cultural reasons for having more children; **M7** less availability of contraception; **M8** less education or jobs (for women);	**5**	ora HICs throughout **ignore** living standards unqualified **M3 accept** food or water insecurity

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Question	Answer	Marks	Guidance
3(a)(i)	number of tourists (per year);	**1**	
3(a)(ii)	*any two from:* *supports:* **M1** no direct correlation / graphs are not directly proportional; **M2** as the number of tourists increases there is no corresponding decrease in number of nests; **M3** as the number of tourists increase there was, only a decrease in 2010 / possible anomaly in 2010 due to another variable; *does not support:* **M4** as number of tourists increases the number of nests decreases overall; **M5** comparative data quote to support M4;	**2**	**must indicate whether it supports or does not support the hypothesis** **ignore** data is inconclusive unqualified **accept** number of penguins for number of nests *does not support:* **accept** number of nests doesn't necessarily indicate population of penguins;
3(a)(iii)	*any two from:* **M1** littering; **M2** boats, spill oil / cause water pollution / disrupt migration patterns; **M3** accommodation needs resources; **M4** need for waste management; **M5** introduce invasive species; **M6** damage to habitat; **M7** noise pollution; **M8** risk of spreading disease; e.g. bird flu	**2**	**List rule applies** **M3 accept** named resource, e.g. energy, food, water, construction materials **M6 accept** scares animals away

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Question	Answer	Marks	Guidance
3(b)(i)	*any four from:* **M1** CFCs; **M2** (CFCs) not broken down in troposphere; **M3** (CFCs) move to stratosphere; **M4** (CFCs) break down in the presence of UV light; **M5** releasing / forming, chlorine atoms; **M6** chlorine, reacts with ozone / breaks down ozone; **M7** chlorine atoms remain (in ozone layer) and continue breaking down ozone;	**4**	**M1 CON** CFCs released from vehicle engines **M1 reject** CO_2 or other incorrect substance **M5 accept** chlorine radicals / Cl •
3(b)(ii)	*any four from:* **M1** low temperatures; **M2** for a long period of time; **M3** allow polar stratospheric clouds (PSCs) to form; **M4** ozone depleting reactions occur on surface of PSCs; **M5** polar vortex; **M6** prevents, ozone / air coming to Antarctica from mid-latitudes;	**4**	
3(c)(i)	*primary consumer:* krill; *three different trophic levels:* orca; *tertiary consumers*: blue whale **and** orca **and** squid **and** gentoo penguins;	**3**	

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Question	Answer	Marks	Guidance
3(c)(ii)	pyramid of energy, is inverted / other way round / reversed / base wider **and** top narrower;	**1**	**accept** widest at the bottom and each level gets smaller as go up;
3(c)(iii)	*any two from:* **M1** less energy is lost (because there are less transfers); **M2** a stated way energy is lost; e.g. movement, waste, heat, respiration, digestion, egestion **M3** only 10% of energy passed on to the next trophic level / 90% of energy is lost between trophic levels;	**2**	

Question	Answer	Marks	Guidance
4(a)	*any three from:* *China has:* **M1** less landfilled; **M2** more mismanaged **and** more incinerated; **M3** more recycled; **M4** comparative data quote; e.g. 13% less landfilled	**3**	ora world **M4 note:** data must be manipulated in some way

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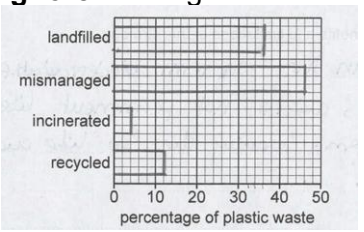
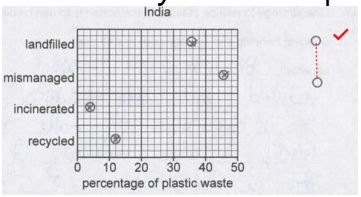
Question	Answer	Marks	Guidance
4(b)	*any two from:* **M1** disposal sites available / waste bins available; **M2** plastics, are recycled / put in landfill / other methods of disposal; **M3** fines for dumping waste / legislation against dumping waste; **M4** financial incentives for recycling; **M5** people are educated on / (more) aware of, environmental issues; **M6** less single use plastics; **M7** use of, bioplastics / biodegradable plastics;	**2**	**List rule applies** **ignore** education and awareness unqualified **M3 accept** legislation on waste management is better enforced
4(c)	**M1** all bars correctly plotted to ± half a small square; **M2** bars of equal width **and** not touching;	**2**	judge straight lines by eye **ignore** shading  **M1 accept** individual points correctly plotted with no lines drawn / single line drawn from *y*-axis to the plotted point 

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Question	Answer	Marks	Guidance
4(d)(i)	*any three from:* **M1** accumulation of toxins in a single organism; **M2** BPA or toxin taken up by producer or consumer; **M3** BPA or toxin, is not excreted / remains in cells / remains in the organism; **M4** (the concentration of) BPA or toxin increases over time in that organism;	**3**	**ignore** concentration accumulates up the food chain (this is biomagnification) **M2 accept** ingested / absorbed, for taken up **M3 accept** BPA or toxin taken in faster than it is excreted
4(d)(ii)	*any two from:* **M1** ingestion / choking / blocks digestion / suffocation; **M2** entanglement / prevents swimming / injury; **M3** microplastics taken into cells; **M4** affects light transmission / reduces photosynthesis; **M5** affects migration patterns; **M6** visual pollution;	**2**	**List rule applies** **ignore** kills marine life / decrease in biodiversity or habitats / biomagnification / water pollution

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Question	Answer	Marks	Guidance
4(d)(iii)	*any four from:* *benefits (max 3):* **M1** decomposes (in time); **M2** impacts are, short-term / not permanent; **M3** uses, plant products / natural products; **M4** can be sustainable; **M5** conserves oil or petroleum / not usually oil or petroleum based; **M6** uses less energy to produce (than conventional plastics); **M7** produces less, carbon dioxide / methane; **M8** helps to educate people; *limitations (max 3):* **M9** they may not decompose completely; **M10** may release harmful substances / can still negatively impact marine life; **M11** expensive to produce; **M12** reinforces single-use culture; **M13** reduces land available for food crops / increases risk of food insecurity;	**4**	numbered ticks **accept** breaks down or degrades for decomposes throughout **M1 accept** decompose faster **M3 accept** made of biological material **M7 reject** doesn't emit any greenhouse gases **M10 accept** can still release some greenhouse gases

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Question	Answer	Marks	Guidance
5	**'Invasive species are the biggest threat to biodiversity.'** The question requirements are to: • show an understanding of the term biodiversity and its importance • describe the impacts of invasive species on food chains and biodiversity • describe other threats to biodiversity • evaluate the statement with particular emphasis on 'the biggest threat'. Candidates may describe biodiversity and its importance in terms of resources, genes (genetic diversity), ecological services, cultural and recreational value. Candidates may describe impacts of invasive species on a specific level, food chain level or ecosystem level. Candidates may describe other threats to biodiversity, including climate change, unsustainable extraction of timber and minerals, agricultural practices, etc. Candidates are likely to be split about the level of threat of invasive species on biodiversity but their reasoning should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.	**20**	

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Question	Answer	Marks	Guidance
6	**Evaluate the success of using renewable resources as a strategy for managing energy security.** The question requirements are to: • show an understanding of renewable and non-renewable resources • show an understanding of energy security • explain the causes of energy insecurity • explain the impacts of energy insecurity • evaluate the success of the strategy. Candidates may describe examples of renewable and non-renewable energy resources. Candidates may describe local, regional, national and global threats to energy security including climate change, natural disasters, conflict, reliance on fossil fuels, population growth, competing demands and inequality of availability . Candidates may describe individual, local, national and global impacts energy insecurity including poverty, low industrial output, disrupted supply, recession, civil disruption and conflict. 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**	

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Mark levels for Question 5 and 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.

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 and mark awarded

- 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.

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

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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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