

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT**8291/11**

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 **23** printed pages.

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.

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 <i>n</i> responses (e.g. State two reasons ...): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>. • Incorrect responses should not be awarded credit but will still count towards <i>n</i>. • 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 <i>n</i> 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 AO1, AO2 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

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
<u>underline</u>	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

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** CH₄ for methane

accept CO₂ CO² Co₂ co₂

accept GHG / GG for greenhouse gases

Question	Answer	Marks	Guidance
1(a)	'an area with characteristic features, such as soil type and vegetation, that contains communities' ticked;	1	reject if more than one tick
1(b)(i)	M1 forest; M2 tundra; M3 200;	3	
1(b)(ii)	M1 –3 and 29 (°C); M2 32 (°C);	2	Correct answer = 2 marks ignore minus sign, i.e. –32 M2 allow ecf
1(c)	<i>any five from:</i> M1 <u>pioneer</u> species; M2 mosses / lichens / fire weed; M3 seeds in soil germinate / seeds becoming new plants / colonise bare soil; M4 soil accumulates further / nutrients added to soil / development of soil / soil replenished / decomposition of pioneer species; M5 small plants / shrubs / bushes / grasses (colonise); M6 intermediate community; M7 trees; M8 reference to colonisation by animal species; M9 <u>climax</u> community;	5	use numbered ticks to show which marking point is awarded ignore reference to time M4 accept reference to ash making soil rich in nutrients / soil becomes deeper M8 accept wildlife, consumers, insects, pollinators for animal species / more complex food chains develop M8 reject bugs M9 accept final <u>climax</u> stage

Question	Answer	Marks	Guidance
1(d)(i)	<i>any three from:</i> M1 develops (internationally agreed) policies; M2 works with many countries / international agreements explained; M3 assists countries to adopt policies / guidelines to suit local industry / helps standardise regulations / (global) timber trade regulations / helps implement laws; M4 collects data, e.g. catalogues tree species / track harvesting and movement of timber globally; M5 promotes sustainable (tropical timber) harvesting / encourages sustainable forest management / regulates amount of logging / prevents over extraction; M6 helps develop capacity in tropical forestry / (programmes) to help plant and grow more trees in tropical forests / afforestation / promotes agroforestry; M7 funds projects, e.g. forest restoration, law enforcement and conservation; M8 promotes education / awareness / study of the forest;	3	List Rule applies ignore prevents / reduces deforestation / cutting down trees unqualified ignore management of timber unqualified ignore reference to animals M5 accept prevents illegal trade in timber

Question	Answer	Marks	Guidance
1(d)(ii)	<i>any three from:</i> M1 illegal cutting down of timber (for trade or profit); M2 members do not follow the guidelines / policies are not legally binding; M3 policies are not enforced / lack government intervention; M4 non-members still harvest their forests / not all countries are members of ITTO; M5 increasing agriculture; M6 increasing food demand; M7 increasing land use for cattle; M8 increasing land use for biofuels / timber cut down and burned to produce energy; M9 increasing land use for building / need timber for building homes / demand for urban expansion / increased urbanisation; M10 increased need for building materials / rising demand for timber or wood; M11 climate change / global warming impact / wildfires; M12 mining or quarrying;	3	List Rule applies ignore deforestation / trees are cut down unqualified ignore land needed unqualified accept population growth requires more land to be cleared M5 – M10 need idea of increasing demand for, not just need for M6 accept increased / more food security M7 accept livestock for cattle M11 accept any stated impact of climate change, e.g. wildfires / tree diseases / hurricanes M11 accept forest fires for wildfires

Question	Answer	Marks	Guidance
2(a)	M1 when all people, at all times, have (physical, social and economic) access to sufficient, (safe and nutritious) food; M2 that meets their dietary needs (and food preferences) / for an active and healthy life;	2	reject M1 for food <u>in</u>security
2(b)(i)	<i>supports:</i> Australians produce more food waste per person (per year) / ora; <i>does not support:</i> total mass for Australia is the lowest / all other countries have a total mass greater than Australia;	2	ignore reference to population size ignore data quotes unqualified, must state most / more / less / least accept (<i>for supports</i>) Australia produces 100 kg as opposed to the other countries that are below 70 kg accept (<i>for does not support</i>) all other countries stated waste more food than Australia
2(b)(ii)	M1 x-axis labelled country and countries named and y-axis labelled <u>mass per person</u> (per year) and kg; M2 suitable linear scale with labelled values on y-axis with data occupying at least half of the grid; M3 5 bars plotted to within $\pm$ half of a small square; M4 bar chart and bars of equal width and gap between the bars;	4	use numbered ticks to show which marking point is awarded reject M1 if wrong set of data plotted (total mass of food waste per year / million tonnes) but can be awarded M2, M3 and M4 as ECF reject M1 if axes reversed but can be awarded M2, M3 and M4 M2 scale on y-axis must start at 0 (but allow if 0 is not written at the bottom of the y-axis)

Question	Answer	Marks	Guidance
2(c)(i)	<i>any two from:</i> M1 attracts vermin / flies; M2 causes disease; M3 fills up landfill sites; M4 generates carbon dioxide / methane (when it decomposes); M5 can cause water pollution / contaminates water sources; M6 bad smells / odours (from rotting food waste);	2	List rule applies must be specific to food waste in landfills, not impacts of landfill sites in general ignore reference to cost ignore visual pollution M1 accept pests for vermin / named vermin, e.g. rats, seagulls M4 ignore harmful gases
2(c)(ii)	<i>any three from:</i> M1 waste has to be collected / transported; M2 collection uses fossil fuels / requires combustion of fossil fuels; M3 waste is difficult to store / goes off quick / requires refrigeration; M4 nutritional value is variable / low nutritional value; M5 animals may not like food waste / may not be able to consume or digest food waste / may be allergic to the food; M6 waste may contain meat and vegetables / increased concentrations of hormones / potential diseases / may contain (harmful) bacteria or pathogens / may be toxic to animals; M7 people are opposed to food waste as animal feed;	3	List Rule applies ignore climate change ignore harms animals unqualified ignore reference to cost ignore reference to illness in humans unqualified M3 accept reference to rotten food M6 accept may make animals sick accept microplastics in food waste lead to bioaccumulation

Question	Answer	Marks	Guidance
2(d)(i)	<i>benefits: (max 4)</i> M1 reduces use of pesticides / kills pests; M2 low costs / cheap; M3 energy efficient / does not need fossil fuels; M4 does not kill pollinators; M5 no bioaccumulation / biomagnification; M6 no chance of pest resistance; M7 is organic; <i>limitations: (max 4)</i> M8 difficult to use extensively / small scale; M9 normally only used in glasshouses; M10 difficult to manage / requires skilled workforce; M11 success is variable; M12 other species may be targeted; M13 predator may disperse; M14 could become invasive;	5	use numbered ticks to show which marking point is awarded must have one mark from each section to be awarded full marks ignore reference to crop yield / food security <i>benefits:</i> M1 accept safer for humans to handle <i>limitations:</i> reject high initial costs ignore takes longer to work / reference to time scale M10 accept hard to control

Question	Answer	Marks	Guidance
2(d)(ii)	<i>any two from:</i> M1 crops need water to grow / water required for photosynthesis; M2 higher the rate of photosynthesis the higher the growth / yield; M3 water prevents wilting / prevents plants from drying up; M4 (increases) nutrient uptake;	2	M1 accept correct equation for photosynthesis M1 accept without water cannot grow crops M4 accept the idea that water helps supply the nutrients / plants take in nutrients with water

Question	Answer	Marks	Guidance
3(a)	<i>any four from:</i> M1 nitrogen (from the atmosphere) reacts with oxygen; M2 in the high temperatures / in vehicle engines; M3 forms nitrogen monoxide; M4 (nitrogen monoxide / NO_x) is released into the atmosphere in vehicle emissions; M5 (nitrogen monoxide / NO_x) reacts with oxygen and water; M6 to form nitric acid;	4	ignore sulphur dioxide, sulphuric acid M1 and M3 / M5 and M6 accept correct word / symbol equations M2 ignore cars / vehicles unqualified M3 accept nitrogen <u>as</u> nitrogen monoxide as alternative to forms nitrogen monoxide M4 CON nitrogen released in vehicle emissions M6 accept nitrous acid for nitric acid

Question	Answer	Marks	Guidance
3(b)(i)	<i>any four from:</i> M1 (rate of) photosynthesis decreases / slows down rate of photosynthesis; M2 chlorophyll captures / absorbs / traps light energy; M3 produces glucose / organic molecules; M4 plants are producers; M5 all <u>energy</u> in food chain originates from producers; M6 the lower the concentration of chlorophyll the lower the energy in the food chain / ecosystem;	4	M1 accept less photosynthesis means less energy produced M2 accept sunlight for light energy M5 accept reduces energy produced by plants from photosynthesis for other species M6 accept the idea of less photosynthesis, less biomass
3(b)(ii)	<i>any two from:</i> M1 aluminium toxicity (leached from soil); M2 damage fish gills; M3 reduce fish populations / kills fish larva or eggs; M4 defoliation; M5 reduced crop yield; M6 damages brick / stone / steel / iron buildings / (increased) chemical weathering;	2	List Rule applies ignore damages crops accept acidifies lake or oceans / soil acidification accept coral bleaching / prevents marine organisms creating calcareous shells M6 accept erosion of buildings / damage to buildings

Question	Answer	Marks	Guidance
4(a)	<i>any three from:</i> M1 high at poles / high latitudes / Greenland and Antarctica; M2 more high (albedo) areas at south pole / Antarctica; M3 medium around tropic of cancer / <u>North</u> Africa and Middle East; M4 some medium in (inland) Australia / Oceania; M5 low along the Equator / low around the tropic of Capricorn (except Australia); M6 most of Earth's surface is low;	3	ignore references to above and below rather than North and South / top and bottom of map M1 accept <u>north eastern part</u> of North America for Greenland M3 accept Sahara for North Africa and Arabia for Middle East M5 accept South America, Asia, Europe, (most of) North America (except Greenland) but must name at least two of the areas of low albedo for mark.
4(b)(i)	<i>any three from:</i> M1 (albedo is) the ability of a surface to reflect light or solar radiation; M2 higher the albedo the more light or solar radiation is reflected / increases the amount of light or solar radiation reflected from the surface of the Earth; M3 (the more light / solar radiation that is reflected) less is absorbed by the Earth / atmosphere; M4 less energy / heat in the atmosphere; M5 global temperatures should decrease / reduces greenhouse effect;	3	accept air for atmosphere accept UV radiation / UV and IR radiation for solar radiation M1, M2, M3 reject IR only M2 accept more white / lighter surfaces for higher albedo M5 accept reduces global warming

Question	Answer	Marks	Guidance
4(b)(ii)	<i>any three from:</i> M1 ships use fossil fuels / use fuels which release greenhouse gas emissions; M2 <u>devices</u> are costly / difficult or expensive to maintain <u>devices</u>; M3 ships would have to be fitted with the device; M4 bubbles do not last long / are temporary / idea that bubbles burst or pop; M5 too small scale / effect too small / will only have a limited impact on climate change; M6 limited to where ships travel / oceans are vast (can only cover relatively small area) / high or medium albedo areas are on land masses; M7 may negatively impact aquatic organisms / reduces the number of phytoplankton / disrupts marine food chains or webs; M8 not everyone will adopt the strategy / requires international agreements; M9 there may be unintended or negative side effects / new technology, so unreliable / impact unknown / untested;	3	List Rule applies ignore cost unqualified ignore device can fall off ships M5 accept limits effects of climate change rather than reducing emissions that cause it / idea of being a short-term fix rather than fixing the problem in the long-term M7 ignore disturbs marine environment / organisms M7 accept disruption of marine habitats M8 accept geo-political arguments
4(b)(iii)	<i>any two from:</i> M1 space reflectors / space mirrors / satellites outside atmosphere reflect sun's rays; M2 stratospheric aerosols; M3 whitening clouds / planting ground cover / whitening roofs;	2	List Rule applies M3 accept marine cloud whitening / marine cloud brightening / afforestation or reforestation accept carbon capture / carbon storage

Question	Answer	Marks	Guidance
4(c)(i)	<i>idea that</i> adaptation aims to limit the impacts of climate change / adaptation does not try to stop or reduce climate change;	1	accept people learning to live with climate change / finding solutions to the problems caused by climate change
4(c)(ii)	<i>any one from:</i> M1 change agricultural practices, e.g. drip irrigation / grow drought or heat tolerant crops; M2 reduce risk from sea level rise / build coastal defences / raising road levels / strengthening sea walls / install drainpipes and pumps; M3 improve water supply / improve efficiency of water use / use desalination / reduce water leakage / metering or rationing / reuse grey water; M4 change infrastructure design (to withstand extreme weather) / better designed storm water drains / construction materials that withstand strong winds, rising water or extreme heat; M5 disaster preparation / warning systems (for extreme weather) / wildfires evacuation plans / training rapid response teams / educate the public, e.g. about wildfires / flooding;	1	List Rule applies ignore education unqualified ignore migration accept a description of any correct specific example of an adaptation to climate change, e.g. using AC in high temperatures

Question	Answer	Marks	Guidance
5	‘Countries with low-income economies have a greater impact on climate change than countries with high-income economies.’ The question requirements are to: • show an understanding of climate change • describe the causes of climate change • describe the impacts of climate change • describe LICs and HICs • evaluate the statement with particular emphasis on ‘a greater impact’. Candidates may describe the differences between LICs and HICs, such as: • energy security • economic drivers • availability of renewable energy • reliance on fossil fuels • population changes. Candidates are likely to be split about the statement but their reasoning should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.	20	

Question	Answer	Marks	Guidance
6	Evaluate the success of reducing water usage as a strategy for managing water security. The question requirements are to: • show an understanding of the causes of water insecurity • show an understanding of the impact of water insecurity • describe successful and less successful strategies • describe strategies other than reducing water usage • evaluate the success of this strategy. Candidates should describe the causes of water insecurity, including economy of the country, infrastructure, availability, poverty, population growth and the differing demands of industry, etc. Candidates should describe the impacts of water insecurity, including harm to human health, sanitation, famine, loss of agricultural crops and animals, decrease in industry. Candidates may describe specific examples of strategies, including • sustainable extraction • improved supply • improved irrigation • growing drought tolerant crops • recycling • rain water catchment. 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	

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