



# **Cambridge International AS Level**

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## **ENVIRONMENTAL MANAGEMENT**

**8291/13**

Paper 1 Principles of Environmental Management

**October/November 2023**

### **MARK SCHEME**

Maximum Mark: 80

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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This document consists of **17** printed pages.

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

**Science-Specific Marking Principles**

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
- 2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

**5 'List rule' guidance**

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

**6 Calculation specific guidance**

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g.  $a \times 10^n$ ) in which the convention of restricting the value of the coefficient ( $a$ ) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

**7 Guidance for chemical equations**

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)	<p><i>any two from:</i></p> <p>distributed all around Antarctica; highest density in Weddell Sea; lowest density in Davis Sea / less densely populated around Ross Sea and Cosmonaut Sea / other seas (than Weddell) are less dense;</p>	2
1(b)(i)	<p>pyramid with large base and decreasing trophic levels; each trophic level labelled /trophic level 1, 2 etc.;</p>	2
1(b)(ii)	<p><i>any three from:</i></p> <p>each trophic level uses energy / 90% lost / 10% passed on; for respiration / growth / movement / reproduction / excretion / AVP; humans are quaternary consumers / 4th level consumers / trophic level 5; more efficient to feed at a lower trophic level / named organisms at lower levels;</p>	3
1(b)(iii)	<p><i>any three from:</i></p> <p><i>positive (max 2):</i> aquaculture is a source of food security / reliable source / abundant; allows a harvest of food from a short food chain;</p> <p><i>negative (max 2):</i> (harvesting krill) impacts squid and icefish e.g. decrease in squid / icefish populations; humans harvest squid and icefish; impacts food chain e.g. depletes stocks / overharvesting or increase in whale populations significantly reduces population of krill; netting causes by-catch;</p>	3

Question	Answer	Marks
1(c)	<p><i>any two from:</i></p> <p>random sampling; map with grid; randomly choose coordinates / random number generator / use device to generate coordinates; repeat the survey at different times of day; calculate mean population;</p> <p><b>OR</b></p> <p>systematic sampling; survey along latitude or longitude line; fixed intervals; repeat the survey at different depths; repeat the survey at different times of day; calculate mean population;</p>	2

Question	Answer	Marks
2(a)	<p><i>any three from:</i></p> <p>from 1880 to 1940 / before 1940 / until 1940, mean temperatures were below (the 100-year average); from 1940 to 1975 mean temperatures fluctuated above and below (the 100-year average); from 1975 to 2020 mean temperatures fluctuated but were above (the 100-year average); trend from 1975 to 2020 mean temperatures increased above (the 100-year average) / correctly quoted data trend for stated year range; overall trend described (for 100-year period) e.g. mean sea surface temperatures increased (from below 100-year average to above 100-year average) / getting warmer / increasing;</p>	3

Question	Answer	Marks
2(b)(i)	<p><i>any three from:</i></p> <p>(from 1980) average temperatures increase <b>and</b> lobsters start to move N / migrate away from original location;    seas are cooler, as latitude increases / the further N you go;    migrating (N) puts the lobster in their preferred temperature / temperature used to / habitable temperatures / where it is cooler;    as temperature continues to increase lobster move further N / further away from their original location;</p>	3
2(b)(ii)	<p><i>any three from or developed points:</i></p> <p>melting of sea ice / ice sheets / glaciers;    increase in sea level;    leading to flooding of beaches and shallow water;    change in ocean currents;    change in wind circulation;    (increased storm frequency) leads to increased turbidity in the water;    ocean acidification / decrease in pH / increase in acidity;    coral bleaching / damages or kills coral <u>reef</u>;    invasive species;</p>	3
2(c)(i)	<p><i>any two from:</i></p> <p>sulfate aerosols;    release method described e.g. spraying aerosol into stratosphere using high altitude airplane / tethered balloon / high altitude blimp or artillery;    reduces incident light / reflects (sun)light / reduces the (Sun's) rays that get to the surface;</p>	3

Question	Answer	Marks
2(c)(ii)	<p><i>any six from:</i></p> <p><i>benefits:</i> simple process / easy to do; relatively inexpensive compared to other strategies; mimics a natural process; technologically feasible;</p> <p><i>limitations (max 5):</i> unknown effects on weather / untested / adverse effects it may or may not have; may cause droughts / flooding; would affect nations differently; doesn't solve the underlying issue of greenhouse gas emissions; application would have to be continually repeated / short-term; technology not fully developed / don't know it will actually work / not much research available; finding a method to deliver the aerosols; only affects temperature not other factors such as increased carbon dioxide causing acidification of oceans; who controls it;</p>	6

Question	Answer	Marks
3(a)(i)	<p><i>any four from:</i></p> <p>increased susceptibility to crop disease; named example e.g. potato blight or corn leaf blight; increased susceptibility to natural disasters; named example e.g. flooding; increased susceptibility to climate change; named example e.g. global temperatures not favourable or drought;</p>	4

Question	Answer	Marks
3(a)(ii)	<p><i>any four from:</i></p> <p>increase in population; unsustainable production; price setting; land degradation; agricultural disease; diverting crops for biofuels; climate change / global warming / severe weather events e.g. hurricanes or flooding; water shortages / drought; poverty as some people or countries unable to afford food;</p>	4
3(b)(i)	<p><i>any three from:</i></p> <p>(increased resistance) allows crops to be sprayed with herbicide / (herbicide) will not harm crops; herbicide kills weed species; reduces competition; crop yield (per unit area) increases / more crops / increase in production of food;</p>	3
3(b)(ii)	$88 - 25 = 63$ <b>and</b> $63/12$ or $(88 - 25) / 12$ ; 5.3;	2

Question	Answer	Marks
3(b)(iii)	<p><i>any five from:</i></p> <p><i>positive (max 4):</i>            little chance of environmental impact;            doesn't require expensive biotechnology / can be done anywhere;            allows farmer to choose desired traits e.g. of crops or livestock they may want;            higher yields may lead to price reduction (more affordable);            improved income for farmer;</p> <p><i>negative (max 4):</i>            can only improve features that are already present / cannot be used to introduce new features;            slow process / takes a long time;            reduces gene pool / can lead to homogeneity;            increases susceptibility to disease;            rare diseases can be selected for;            moral objections e.g. 'playing god';            requires some knowledge;</p>	5

Question	Answer	Marks
4(a)	<p><i>any three from:</i></p> <p>slightly more males than females 0–29 / males and females roughly even or not significantly different 0–29;            more females than males over 50;            much more females than males in the highest age groups / over 80;            comparative data quote e.g. 121 000 males 0–4 compared to 117 000 females;            qualitative comparison for any individual bar e.g. more males than females 0–4;</p>	3
4(b)(i)	successive age ranges below 30 are decreasing / lower age ranges are smaller than higher age ranges / narrower base than middle;	1

Question	Answer	Marks
4(b)(ii)	<p><i>any three from:</i></p> <p>improved availability of contraception;  improved education on contraception;  improved education and opportunities for women;  anti-natalist policy e.g. legislation or laws to limit number of children per family;  cost of living / cost of raising children is a disincentive to having children;  family planning;</p>	<b>3</b>
4(c)(i)	<p>dependency ratio is <u>lower</u> in Uruguay;  Uruguay has a <u>lower</u> proportion of dependents / Uruguay has a greater proportion of working age people;</p>	<b>2</b>
4(c)(ii)	<p><i>any three from:</i></p> <p>higher pension spending;  pressure on healthcare e.g. old people need more medical care so impacts economy for healthcare / resources available;  pressure to raise retirement age;  more expertise in workplace;  less people in the workforce / old people can no longer work;  lower birth rate / old people past age of child bearing;</p>	<b>3</b>

Question	Answer	Marks
5	<p><b>'Improved agricultural techniques will ensure global food security by 2040.'</b></p> <p><b>To what extent do you agree with this statement?</b></p> <p><b>Give reasons and include information from relevant examples to support your answer.</b></p> <p>The question requirements are to:</p> <ul style="list-style-type: none"> <li>• show an understanding of food security</li> <li>• describe examples of improved agricultural techniques such as: aquaculture and hydroponics; vertical farming; use of selective breeding and genetically modified (GM) crops to develop pest-resistant crops with a higher yield; drought and salt tolerant crops; controlling limiting factors e.g. use of fertilisers in areas short of nutrients; increasing productivity by removing competition from weeds by use of herbicides; reduction of disease by use of fungicides; reducing pest species by use of biological control; no plough; direct drilling; intercropping; agroforestry;</li> <li>• evaluate the statement with particular consideration for 'all countries by 2040'</li> </ul> <p>This question assesses AO2 and AO3 skills.</p> <p><b>Indicative content</b></p> <p>Candidates may use specific examples of improved agricultural techniques and efficiencies, including case studies.</p> <p>The wide range of techniques will all have limitations that may be outlined by candidates.</p> <p>Candidates need to focus on 'global food security' and 'by 2040' when evaluating the statement.</p> <p>Candidates may agree or disagree but answer should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.</p>	20

Question	Answer			Marks													
5	<p><b>Generic levels of response</b></p> <table border="1"> <thead> <tr> <th data-bbox="332 290 467 350">Level</th><th data-bbox="467 290 1837 350">AO2: Information handling and analysis</th><th data-bbox="1837 290 1949 350">Marks</th></tr> </thead> <tbody> <tr> <td data-bbox="332 350 467 493">3</td><td data-bbox="467 350 1837 493"> <ul style="list-style-type: none"> <li>Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic.</li> <li>Incorporates frequent use of directly relevant examples.</li> </ul> </td><td data-bbox="1837 350 1949 493">7–8</td></tr> <tr> <td data-bbox="332 493 467 636">2</td><td data-bbox="467 493 1837 636"> <ul style="list-style-type: none"> <li>Responses contain explanations with some gaps or errors in the reasoning.</li> <li>Explanations may lack detail or accurate knowledge.</li> <li>Examples are included but some opportunities to include relevant examples are missed.</li> </ul> </td><td data-bbox="1837 493 1949 636">4–6</td></tr> <tr> <td data-bbox="332 636 467 811">1</td><td data-bbox="467 636 1837 811"> <ul style="list-style-type: none"> <li>Responses contain a few general points, which are mainly descriptive, comprising a few simple points.</li> <li>Knowledge is basic and understanding may be poor and lack relevance to the question set.</li> <li>Irrelevant or no examples are given.</li> </ul> </td><td data-bbox="1837 636 1949 811">1–3</td></tr> <tr> <td data-bbox="332 811 467 884">0</td><td data-bbox="467 811 1837 884"> <ul style="list-style-type: none"> <li>No creditable response.</li> </ul> </td><td data-bbox="1837 811 1949 884">0</td></tr> </tbody> </table>	Level	AO2: Information handling and analysis	Marks	3	<ul style="list-style-type: none"> <li>Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic.</li> <li>Incorporates frequent use of directly relevant examples.</li> </ul>	7–8	2	<ul style="list-style-type: none"> <li>Responses contain explanations with some gaps or errors in the reasoning.</li> <li>Explanations may lack detail or accurate knowledge.</li> <li>Examples are included but some opportunities to include relevant examples are missed.</li> </ul>	4–6	1	<ul style="list-style-type: none"> <li>Responses contain a few general points, which are mainly descriptive, comprising a few simple points.</li> <li>Knowledge is basic and understanding may be poor and lack relevance to the question set.</li> <li>Irrelevant or no examples are given.</li> </ul>	1–3	0	<ul style="list-style-type: none"> <li>No creditable response.</li> </ul>	0	
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Question	Answer			Marks
5	Level	AO3: Investigation skills and making judgements		
	4	<ul style="list-style-type: none"> <li>Clearly presents and develops both sides of the argument.</li> <li>Judgements are fully supported with relevant qualitative and/or quantitative information.</li> <li>Clear, balanced conclusion which is consistent with the question and candidate response.</li> </ul>	10–12	
	3	<ul style="list-style-type: none"> <li>One side of the argument is better developed than the other.</li> <li>Judgements are partially supported with qualitative and/or quantitative information.</li> <li>Conclusion is consistent with the question and candidate response.</li> </ul>	7–9	
	2	<ul style="list-style-type: none"> <li>Describes only one side of the argument.</li> <li>Judgements have minimal support; qualitative or quantitative information lacks relevance.</li> <li>Conclusion may be inconsistent with the question and candidate response.</li> </ul>	4–6	
	1	<ul style="list-style-type: none"> <li>Response is descriptive.</li> <li>Minimal judgement is made, unsupported by qualitative or quantitative information.</li> <li>Conclusion is inconsistent with the question and candidate response, or no conclusion made.</li> </ul>	1–3	
	0	<ul style="list-style-type: none"> <li>No creditable response.</li> </ul>	0	

Question	Answer	Marks
6	<p><b>Evaluate captive breeding and release as a method of conserving biodiversity.</b>  <b>Give reasons and include information from relevant examples to support your answer.</b></p> <p>The question requirements are to:</p> <ul style="list-style-type: none"> <li>• show an understanding of the importance of biodiversity</li> <li>• show an understanding of captive breeding and release programmes</li> <li>• describe successful and less successful examples</li> <li>• evaluate the statement on a local, country and global level</li> </ul> <p>This question assesses AO2 and AO3 skills.</p> <p><b>Indicative content</b></p> <p>Candidates may provide a definition of biodiversity along with an understanding of its importance. The importance should highlight ecological, economic, recreational, cultural and scientific reasons.</p> <p>Candidates may use specific examples of individual, local and national captive breeding programmes, including case studies. The examples should be balanced and show successful and less successful programmes.</p> <p>Candidates may describe the limitations of captive breeding.</p> <p>Candidates are likely to be split over their conclusion but answer should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.</p>	20

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

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