



Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT

8291/12

Paper 1 Principles of Environmental Management

October/November 2022

MARK SCHEME

Maximum Mark: 80

Published

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

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

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

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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

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 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	<p><u>'List rule' guidance</u></p> <p>For questions that require <i>n</i> responses (e.g. State two reasons ...):</p> <ul style="list-style-type: none">• 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.

PUBLISHED

Question	Answer	Marks
1(a)(i)	trophic level 3 / 3;	1
1(a)(ii)	grass uses photosynthesis; to produce (stored) energy / produce own food / provides food for primary consumer; from sunlight energy;	2
1(a)(iii)	shape comment / wide base / tapering top; in order to support the food chain / energy highest at the bottom; more individuals are needed to provide energy; energy decreases as go up each level / energy is lost or wasted; e.g. respiration / reproduction / AVP;	3
1(b)(i)	a species not native / do not belong / foreign to a habitat; introduced deliberately or accidentally; which causes harm to / has a negative impact on the habitat / named example;	2
1(b)(ii)	the loss of ants and insects; due to predation by Fire ants; due to competition for resources with Fire ants; means less for secondary consumers; less for apex predators; disrupts the food web; native ants are detritivores; fewer native ants mean less cycling of nutrients through the food chain;	3

Question	Answer	Marks
1(c)(i)	<i>land clearance for:</i> agriculture; urbanisation / industry; construction of roads; deliberate burning; mining; hunting / poaching; tourism;	2
1(c)(ii)	legislation, e.g. land clearance / hunting or poaching / protected areas or national parks; education on importance of conservation; encourage local people to have a vested interest in conservation; captive breeding and release programme for endangered species; ecotourism;	4

PUBLISHED

Question	Answer	Marks
2(a)	<p><i>any two points developed for total 4 marks:</i></p> <p>For X: (plants release) water into the atmosphere; (through transpiration) from stomata / diffusion through stomatal pores into atmosphere; or (through evaporation) from mesophyll cells / (surface of) leaves;</p> <p>For Y: plants intercept / catch water; reducing the flow to water bodies / surface run-off;</p>	4
2(b)	<p>urbanisation introduces hard / non-absorbent surfaces; precipitation doesn't enter the soil / less ground water; less trees and plants; reduces interception / evapotranspiration; increased amount of run-off / enters streams and rivers more rapidly; increased risk of flooding; salt water intrusion; pollution of water cycle, e.g. chemical waste from industry;</p>	4

PUBLISHED

Question	Answer	Marks
3(a)(i)	3.26 / 3.3; 203 452 505;	2
3(a)(ii)	Germany: 54.3; $(10\,323\,982) + (17\,991\,838) \times 100 / (52\,141\,917)$;	2
3(a)(iii)	<p><i>HIC / Germany:</i></p> <p>better health care;</p> <p>increased life expectancy;</p> <p>lower death rate / infant mortality rate;</p> <p>lower birth / fertility rate;</p> <p>education / availability on contraception or family planning;</p> <p>better standard of living, e.g. food supply, weatherproof homes, clean water;</p> <p>migration of working age people;</p> <p><i>LIC / Nigeria:</i></p> <p>accept reverse argument for each point</p>	4

PUBLISHED

Question	Answer	Marks
3(b)	<p><i>any valid developed point explained to total 2 marks:</i></p> <p><i>economic factors:</i> low income / unemployment; migrate to more developed areas where greater job opportunities / better pay;</p> <p><i>social / cultural factors:</i> young people moving away due to family conflicts / for greater independence; improved communication / leisure facilities such as transportation, cinema; education facilities / opportunities; religious persecution;</p> <p><i>political factors:</i> war / conflict; refugees fleeing for their safety; migrate to place more in line with the individuals' political ideas;</p> <p><i>environmental factors:</i> natural disasters, e.g. flooding or drought; physical aspects, e.g. moving from mountainous region to lower lying land where more fertile land for agriculture;</p>	2
3(c)	<p><i>any two developed points:</i></p> <p>improved availability of contraception; allows control of family size / family planning;</p> <p>improved education about contraception; allows correct use of contraception / likely to be more effective;</p> <p>improved education and opportunities for women; gives women enhanced opportunities for choice / decision making / control of fertility;</p> <p>improved health care; better infant and childhood health / less die / less need to have large number of children;</p> <p>pronatalist and anti-natalist policies / United Nations (UN) Agenda 21 / The Club of Rome; manage consequences of high / low birth rate, e.g. build more houses, incentives to have children / limit number of children;</p>	4

PUBLISHED

Question	Answer	Marks
4(a)(i)	fluctuates / goes up and down / overall decrease; decrease between 2010 and 2011; rises between 2011 and 2014; steep drop between 2015 to 2017; plateaus (2017 to 2019); rising a little in 2020;	2
4(a)(ii)	a natural (long-term) cyclical change; rising sea temperature; increases sea ice melting; rising air temperature; increases land ice melting; increased water entering sea ice area promotes melting; climate change due to global warming / enhanced greenhouse effect; caused by increased greenhouse gas / named greenhouse gas levels; El Niño effect;	4
4(b)(i)	leaders change / different viewpoints are held; political considerations; economic and commercial considerations; enforcement / lack of monitoring; requires all countries to agree; traditional / historic views must be considered;	3
4(b)(ii)	protected areas; fisheries regulation; whale conservation; prohibited activities such as mineral extraction; protection from non-native animals or plants; waste management; regulation of scientific research activity; tourism control; permits for travel;	4

PUBLISHED

Question	Answer	Marks		
5(a)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"><i>non-renewable</i> oil nuclear</td> <td style="width: 50%; border: none;"><i>renewable</i> wind solar geothermal</td> </tr> </table>	<i>non-renewable</i> oil nuclear	<i>renewable</i> wind solar geothermal	2
<i>non-renewable</i> oil nuclear	<i>renewable</i> wind solar geothermal			
5(b)	the reliable availability of energy sources; at an affordable price; with a consideration of the environmental impacts;	2		
5(c)	<p><i>any two valid developed points to total of four marks:</i></p> <p>fossil fuel depletion; leads to shortages / price increases;</p> <p>inequality in global energy resources; leads to some people not having access to affordable fuel; dependence / reliance on only one energy source;</p> <p>population growth; increases demand for limited supply;</p> <p>differing energy needs of countries in different income groups; leads to differing experiences of fuel insecurity;</p> <p>climate change; change to renewable energy sources / aim to become carbon neutral;</p> <p>supply disruption; leads to shortages / uncertainty; named, e.g. natural disasters / piracy / terrorism / war;</p>	4		

PUBLISHED

Question	Answer	Marks
6	<p>‘Reduce, Reuse and Recycle is the most important strategy to manage waste disposal.’</p> <p>To what extent do you agree with this statement?</p> <p>Give reasons and include information from relevant examples to support your answer.</p> <p>The question requirements are to:</p> <ul style="list-style-type: none"> • show understanding of strategies to manage waste disposal • show understanding of the slogan and its effectiveness • provide relevant information to support a balanced argument. <p>This question assesses AO2 and AO3 skills.</p> <p>Indicative content Some consideration of a range of methods of waste disposal for comparison is expected.</p> <p>Candidates to evaluate the success of Reduce, Reuse and Recycle as a strategy for waste disposal.</p> <p>Candidates should refer to the need to educate people in the purpose and the parts of the strategy.</p> <p>Methods for discussion should include biodegradable plastics as a replacement for single-use plastics, the issues raised by plastic pollution and the need to reduce the volume entering the environment, food waste for animal feed, composting as a method of recycling biodegradable wastes and consequently re-using them as growth media and fertilisers for crops, fermentation as a method of producing another useable product from waste, use of waste to generate energy in the form of different biofuels.</p> <p>Education as a key tool to promote the idea of sustainable use of resources, reduction of wastes and the recycling and re-use of appropriate substances. A wide range of items could figure here including clothing, plastics, metal items, etc.</p>	20

PUBLISHED

Question	Answer	Marks															
6	<p>Financial incentives and legislation to encourage and enforce, for example cash for cans, refundable returns on bottles, charging for plastic bags, etc.</p> <p>Candidates should also refer to the problems caused by different strategies of waste disposal: contamination of soil leading to leaching and contamination of ground water, build-up and release of the greenhouse gas methane (CH₄) with a danger of explosions, visual and noise pollution and unpleasant odour, risk of spread of disease, flies and vermin, release of toxic substances, bioaccumulation and biomagnification, plastics and microplastics in oceans.</p> <p>General levels of response</p> <table border="1" data-bbox="338 555 1924 1137"> <thead> <tr> <th data-bbox="338 555 497 620">Level</th> <th data-bbox="497 555 1803 620">AO2: Information handling and analysis</th> <th data-bbox="1803 555 1924 620">Marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="338 620 497 756">3</td> <td data-bbox="497 620 1803 756"> <ul style="list-style-type: none"> Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic. Incorporates frequent use of directly relevant examples. </td> <td data-bbox="1803 620 1924 756">7–8</td> </tr> <tr> <td data-bbox="338 756 497 895">2</td> <td data-bbox="497 756 1803 895"> <ul style="list-style-type: none"> Responses contain explanations with some gaps or errors in the reasoning. Explanations may lack detail or accurate knowledge. Examples are included but some opportunities to include relevant examples are missed. </td> <td data-bbox="1803 756 1924 895">4–6</td> </tr> <tr> <td data-bbox="338 895 497 1067">1</td> <td data-bbox="497 895 1803 1067"> <ul style="list-style-type: none"> Responses contain a few general points, which are mainly descriptive, comprising a few simple points. Knowledge is basic and understanding may be poor and lack relevance to the question set. Irrelevant or no examples are given. </td> <td data-bbox="1803 895 1924 1067">1–3</td> </tr> <tr> <td data-bbox="338 1067 497 1137">0</td> <td data-bbox="497 1067 1803 1137"> <ul style="list-style-type: none"> No creditable response. </td> <td data-bbox="1803 1067 1924 1137">0</td> </tr> </tbody> </table>	Level	AO2: Information handling and analysis	Marks	3	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> No creditable response. 	0	
Level	AO2: Information handling and analysis	Marks															
3	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> No creditable response. 	0															

PUBLISHED

Question	Answer			Marks
6	Level	AO3: Investigation skills and making judgements	Marks	
	4	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • No creditable response. 	0	

PUBLISHED

Question	Answer	Marks
7	<p>Evaluate strategies for managing food security in a country of your choice.</p> <p>Give reasons and include information from relevant examples to support your answer.</p> <p>The question requirements are to:</p> <ul style="list-style-type: none"> • show understanding of food security • describe strategies to manage food security • evaluate the relative success of strategies to manage food security. <p>This question assesses AO2 and AO3 skills.</p> <p>Indicative content</p> <p>Candidates will choose from the range of strategies in the syllabus, describe them and evaluate the relative success.</p> <p>Candidates may refer to HICs and LICs in their evaluation though this is not required.</p> <p>Expected strategies to include subsistence agriculture where sufficient food for needs is produced (hopefully) with no surplus to trade resulting in no income and difficulty in buying new seed, tools and fertilisers, the increase of food production by intensification through the use of a large amount of labour and capital relative to the land area due to fertilisers, pesticides and machinery needed, and extensification through the increased amount of land cultivated.</p> <p>Improved agricultural techniques and efficiency through aquaculture and hydroponics, use of selective breeding and genetically modified (GM) crops to developing pest resistant crops and crops with a higher yield, controlling limiting factors, e.g. use of fertilisers in areas short of nutrients, increasing productivity by removing competition from weeds by the use of herbicides, reducing fungal disease by use of fungicides, reducing pest species by use of biological control.</p> <p>Answers may also include reduction in livestock and increase in growing crops, reduce food waste, large-scale food stockpiling, improve transportation of food, protecting pollinating insects, the World Food Programme and food aid and potentially the need for rationing. Some reference to NGOs providing support and education to subsistence farmers.</p>	20

Question	Answer		Marks
7	General levels of response		
	Level	AO2: Information handling and analysis	Marks
	3	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • No creditable response. 	0	

PUBLISHED

Question	Answer			Marks
7	Level	AO3: Investigation skills and making judgements	Marks	
	4	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • No creditable response. 	0	