Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT   **8291/21**

Paper 2   **May/June 2021**

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.

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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	‘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   <u>Calculation specific guidance</u>

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   <u>Guidance for chemical equations</u>

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)(i)	areas facing shortage are increasing / more countries in highest group; most spread across Middle East / Asia and North Africa; almost entirely northern hemisphere; stays the same / no change in South America / Oceania; USA moves into higher category; use of correct data in support of a change; **max 3**	**3**
1(a)(ii)	increasing aridity / less precipitation; persistent drought; climate change; likely poor water management; population not conserving water; increased population; increased industrialisation / increasing number of industries; increased irrigation in agriculture; **max 2**	**2**
1(a)(iii)	education; not doing things with running water; reduce amount in toilets; not washing cars; repair leaks; improve catchment and storage; provide a new source / alternative source e.g. desalination; method / type of recycling / re-using 'waste' water; **max 2**	**2**

Question	Answer	Marks
1(b)(i)	**Domestic** Egypt has less developed infrastructure; Egypt has less sanitation; Egypt arid; USA has increased population / more people; **Industrial** USA more industrialised; USA is more economically developed; **max 2**	2
1(b)(ii)	sea water is filtered; to remove solids and other unwanted particles; passed through membranes; reverse osmosis occurs; separating dissolved minerals / salts; freshwater treated to health standards; **max 4**	4

Question	Answer	Marks
1(b)(iii)	**Advantages** it provides potable water for people / livestock; in arid areas; it provides water for agriculture / horticulture; it uses an available / abundant resource; it isn't reliant on climate / rainfall; preserves / reduces drawdowns from natural sources e.g. aquifers / reservoirs; **Disadvantages** costly; consumes a lot of energy / resources; large volume of waste water; has to be built in coastal areas / needs infrastructure / transport; environmental issues; removes some of the taste of water; **max 4**	4
1(c)	increasing temperature / global warming; increases evaporation / groundwater evaporates; more / less rainfall; extreme weather events such as flooding, storm surges, drought; leads to contamination of freshwater supplies; glaciers melt; increased flow in rivers; increased flow to oceans; polar ice melts faster; freshwater to seawater increases; **max 3**	3

Question	Answer	Marks
2(a)(i)	glucose / sugar / $C_6H_{12}O_6$;	**1**
2(a)(ii)	chloroplasts; contain chlorophyll; <u>absorbs</u> + sunlight / light / energy from the sun; **max 2**	**2**
2(a)(iii)	(increasing carbon dioxide) increases rate of photosynthesis; but then plateaus; when something else becomes limiting factor; named example e.g. temperature; carbon dioxide eventually becomes limiting factor; only uses red and blue wavelengths; **max 3**	**3**
2(a)(iv)	**abiotic** sunlight / energy from the sun / light; water / rain / humidity; temperature; oxygen; salinity; pH soil; magnesium / chlorophyll / named mineral; **biotic** producers; consumers; decomposers; predation; trampling; competition for resources; described example e.g. plants shaded from light; pollination; pests / insects; **max 2**	**2**

Question	Answer	Marks
2(b)(i)	equatorial; north / south of equator; within / between tropics; often coastal; not in North America; **max 2**	**2**
2(b)(ii)	high temperature; high moisture; ideal for decomposers / detritivores; e.g. bacteria / fungi / termites; (large amounts of litter falls) rapidly recycled / broken down; organic matter; recycled as nutrients; **max 3**	**3**
2(b)(iii)	constant high abiotic factors; named factor; means high energy availability / allows increased speciation; layered structure / provides wide range of habitats; the wide floral biodiversity / provides wide range of food sources; **max 3**	**3**

Question	Answer	Marks
2(b)(iv)	**Soil** removes roots; no longer bind the soil; increased erosion; soil dries / increased desertification; loss of soil fertility; **Humans** reduces food sources; loss of medicinal plants; loss of fuel wood; loss of home / income for indigenous peoples; cultural loss for indigenous peoples; habitat destruction; reduction in carbon intake (by young, growing trees); reduction in carbon storage (by mature trees); **max 4**	**4**

Question	Answer	Marks
3(a)	**Causes** Overuse / use of pesticides, loss of habitats, lack of food, loss of farm borders with flowers, loss of gardens, increasing effects of vehicles, drainage of wetlands, climate change. **Effects** Disruption of food chains/webs, lack of prey/food, lack of insect predators, lack of pollinators affects plants including human crops, and loss of detritus feeders increases detritus. **please use level descriptors 1**	10

3(b)	The requirements for this question are:
	
	   • to demonstrate understanding that steps need to be taken to manage conservation of species
	   • to demonstrate understanding of the different strategies to manage conservation of species
	   • to evaluate strategies to manage conservation of species and give examples
	
	Candidates should provide detailed descriptions of a range of named examples of conservation strategies including conservation areas, national parks, habitat protection (SSSIs / ecological islands), and legislation to control the use of damaging chemicals such as pesticides including banning nicotinoid containing pesticides.
	
	Ecotourism is a potential solution.
	
	Putting species on e.g. the red list of endangered species.
	
	Candidates should assess the relative merits of these strategies.
	
	please use level descriptors 2
		30

Question	Answer	Marks
4(a)	The river Ganges flows from the Himalayas through the top of India and into Bangladesh. On its route through India, it passes many large cities which pour a great deal of untreated sewage into the water leading to hypoxic (dead) zones downriver with areas deemed severe and critical. There is a lot of industry along the river especially polluting ones such as dyeing, leatherworks and sugar processing. The river also passes through agricultural areas and experiences eutrophic areas from the run-off from the fields. Candidates may also refer to disposal of bodies and bathing practices. **please use level descriptors 1**	10
4(b)	The requirements for this question are: • to demonstrate knowledge of the methods of pollution control • to show understanding of local and regional strategies • to assess the relative success of chosen examples. A range of different methods described including sewage treatment plants, legislation, education and reinforcement measures. Control of industrial discharge and steps to reduce agricultural run-off. Provision of infrastructure. Some understanding of the difficulties involved in implementation and enforcement and the difference between local and regional policies. Financial and political will issues. Assessment of the relative success of strategies. **please use level descriptors 2**	30

Question	Answer	Marks
5(a)	There are several strands to the source material: • one providing a means to reduce surface water run-off from hard surfaces by use of permeable paving materials, • another to provide green spaces and garden areas including walls and roofs to offset the issues of air pollution, heat island effect and climate change, • another to harvest renewable energy sources and reduce waste water and • one to provide for well-being by having plants and trees in the open spaces. Candidates are expected to apply understanding of the background theory to these situations and to suggest advantages and disadvantages. **Advantages** could include environmental such as reduced carbon emissions, reduced risk of flooding, offset to damaging effects, improved air quality and improved well-being of citizens. Some measure of helping wildlife as well. Energy saving/not using non-renewable energy resources. Recycling/re-use of waste. **Disadvantages** are the cost, the need for a political will, education and understanding of the people, potential for vandalism and the need to balance against the requirements of the population to function e.g. transport and the need for resources balanced against preservation. **please use level descriptors 1**	10

Question	Answer	Marks
5(b)	The requirements for this question are: • to demonstrate a knowledge of different international protocols • to understand the problems of agreement and enforcement • to assess the relative success of these agreements • to relate the wider global situation to the green cities. Candidates may relate the concept of green cities to the wider picture of international protocols aimed at reducing the various threats to the environment. There are many protocols beginning with Montreal and Kyoto and several recent ones such as Paris and Katowice (the David Attenborough speech) aimed at atmospheric pollution and wildlife protection. Pollution does not acknowledge international boundaries. Water may also be cited as an issue (damming and over-extraction) Candidates should be able to describe the difficulties in reaching such agreements and will be able to assess success or otherwise (and may cite the USA pulling out of Paris) as well as the difficulties of enforcement. Candidates may choose to approach the issue from a global warming/climate change viewpoint, describing the different ways human population growth is impacting the environment and add in the protocols. **please use level descriptors 2**	10

Question	Answer	Marks
	Section B descriptor levels:	

Descriptor	Award Mark
Consistently meets the level criteria	Mark at top of level
Meets the criteria, but with some inconsistency	Middle, mark to just below top mark
Meets most of level criteria, but not all convincingly	Just below middle, mark to just above bottom mark
On the borderline of this level and the one below	Mark at bottom of level

Section B (part a),

Level descriptors 1

8–10 marks
The response:
- contains few errors
- shows a very good understanding of the question
- shows a good use of data or the information provided, where appropriate
- provides a balanced answer

5–7 marks
The response:
- may contain some errors
- shows an adequate understanding of the question
- shows some use of data or the information provided, where appropriate
- may lack balance

1–4 marks
The response:
- may contains errors
- shows limited understanding of the question
- shows little or no use of data or the information, where appropriate
- lacks balance

Question	Answer	Marks
	Section B (part b): Level descriptors 2 Responses: **Level one, 25–30 marks** • fulfil all the requirements of the question • contain a very good understanding of the content required • contain a very good balance of content • contain substantial critical and supportive evaluations • make accurate use of relevant vocabulary **Level two, 19–24 marks** • fulfil most of the requirements of the question • contain a good understanding of the content required • contain a good balance of content • contain some critical and supportive evaluations • make good use of relevant vocabulary **Level three, 13–18 marks** • fulfil some requirements of the question • contain some understanding of the content required • may contain some limited balance of content • may contain brief evaluations • make some use of relevant vocabulary **Level four, 6–12 marks** • fulfil limited requirements of the question • contain limited understanding of the content required • may contain poorly balanced of content • may not contain evaluations • make limited use of relevant vocabulary	

Question	Answer	Marks
	Level five, 1–5 marks • fulfil a few of the requirements of the question • contain a very limited understanding of the content required • are likely to be unbalanced and undeveloped • evaluative statements are likely to be missing • make no use of relevant vocabulary	