CAMBRIDGE
International Education

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT **8291/21**

Paper 2 Management in Context **May/June 2025**

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 May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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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 descriptions 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.

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 AO**1**, AO**2** etc.
	Level of Response. Number indicates the level awarded to the response (mark scheme details mark ranges for each level)
	correct awarding one mark from marking point or marking group 1. similar numbered ticks are used for marking point or marking groups 2, 3, 4 etc.
	response has not answered question
	contradiction in response, mark not awarded

Question	Answer	Marks
1(a)	*any three from:* M1 smaller sample / easy to analyse / easy to process; M2 shows whether questions, are valid / are relevant / meet objectives / are successful / need changing / are understandable / can be answered / contain limitations / contain mistakes / are biased; M3 checks, response rate / target group is met / sampling strategy (is suitable) / sample location (is suitable); M4 shows, whether the questionnaire takes too long / how long questionnaire takes;	**3**
1(b)	*any three from:* *style 1:* M1 less data to analyse; M2 quick(er) (to analyse or complete); M3 simple(r) / more straightforward (to answer); *style 2:* M4 more information available / range of answers will be given / get an opinion / get a personal view; M5 quantitative data;	**3**
1(c)(i)	*any two from:* M1 reduces chance of altering results / permanent record / can go back and listen or watch again; M2 can give detailed answers / can explain answers / direct quotes can be used / allows for personal responses; M3 easy or quick to record answers / don't need to write answers / suitable for illiterate people / more accessible / suitable for visually impaired people; M4 able to, record emotions or tone / see body language; M5 people may be, more honest / less likely to lie;	**2**

Question	Answer	Marks
1(c)(ii)	*any one from:* M1 biased; M2 not representative / no males selected / no data from younger or older women / leaves out some of the population;	**1**
1(d)(i)	*any two from:* M1 cost / lack of funding / not profitable / expensive; M2 other priorities on finances; M3 other methods of waste disposal used e.g. landfill / incineration; M4 lack of land or space; M5 export waste to other countries; M6 limited collection opportunities / limited infrastructure for collection / difficult to transport recycled waste / lack of collection vehicles; M7 some waste used for energy generation (through incineration); M8 low population (density);	**2**
1(d)(ii)	*any two from:* M1 introduce, fine / charge / tax / penalty / sanction; M2 introduce, reward schemes / payment, for recycling; M3 waste not collected, if not sorted or not in recycle bins; M4 limit on amount of general rubbish or non-recycled rubbish, that will be collected; M5 people do not want to get in trouble / people obey laws;	**2**

Question	Answer	Marks
1(e)	*any five from:* M1 risk of, leaching / release of toxic substances / named toxic substance e.g. heavy metals; M2 contamination of soil; M3 contamination of water; M4 emits or build-up of, methane / CH_4; M5 greenhouse gases emitted / emitted gases lead to climate change or global warming; M6 visual / noise / odour, pollution; M7 risk of, vermin / pests; M8 risk of, disease / named disease; M9 bioaccumulation; M10 bioaccumulation described: toxic substances accumulate within an organism; M11 biomagnification; M12 *biomagnification described:* concentration of toxic substances increase up the food chain; M13 habitat loss / biodiversity loss; M14 stated impact on animals e.g. animals ingest plastic; M15 reduces illegal dumping of waste / stops waste ending up in, rivers / oceans; M16 creates jobs / improves local economy;	**5**

Question	Answer	Marks
2(a)(i)	1.70;	**1**
2(a)(ii)	*any two from:* M1 wind / rain / floods / storms, stir up the water / disturb sediments / increase turbulence / change turbidity / reduces visibility (in water); M2 wind or storms, cord will not be vertical / cord will move / difficult to read; M3 wind or storms, cord or disc gets damaged / broken; M4 waves / not flat water / not calm water, difficult to read the cord / make depth variable; M5 (long period of) rain can, water levels that fluctuate / give variable depths; M6 lack of sunlight / cloudy / foggy / overcast / dull day, reduces visibility or difficult to see disc or cord; M7 high sunlight causes glare; M8 cold temperatures water could be frozen; M9 temperature changes particle distribution; M10 safety idea about going on water when bad weather;	**2**
2(a)(iii)	*any two from:* M1 identifies outliers / anomalous results excluded; M2 results can be compared; M3 mean found; M4 get representative data / increases sample size;	**2**
2(b)(i)	Sun;	**1**

Question	Answer	Marks
2(b)(ii)	*any two from:* M1 producers / phytoplankton/plants, contain chlorophyll; M2 as chlorophyll (concentration) increases (population of) producers increase / chlorophyll needed for photosynthesis; M3 higher chlorophyll (concentration) gives greater primary production / (primary) productivity;	**2**
2(c)	*any one from:* M1 as (Secchi) depth decreases chlorophyll or concentration increases / ORA; M2 higher the chlorophyll or higher concentration the lower the (Secchi) depth;	**1**

Question	Answer	Marks
2(d)(i)	*total max four:* *max three benefits:* M1 cheap / costs less; M2 large quantity of data provided; M3 data can be collected from inaccessible areas / (scientist) don't have to travel to all places; M4 representative data / global data; M5 quicker (for scientists) / saves (scientist) time; *max three limitations:* M6 big data / problem of analysing large quantity of data; M7 who owns the data rights; M8 amateurs / non-scientists / non-professionals, collecting data; M9 cannot verify or confirm data / no information about how data collected / subjective / potential for errors / misinterpretation / wrong information; M10 may only come from one areas / some areas not covered; M11 not everyone has access to website;	**4**

Question	Answer	Marks
2(d)(ii)	*any three from:* M1 seas too warm / temperature of sea increases; M2 photosynthesis reduced; *(rising temperatures cause):* M3 change in salinity; M4 increased carbon dioxide concentrations; M5 ocean acidification / decrease in water pH; M6 change in ocean, circulation / currents; M7 phytoplankton cannot adjust to changed conditions; M8 increased risk of invasive species; M9 change in migration of organisms that consume phytoplankton; M10 more extreme weather / storms, increase turbidity (reducing photosynthesis);	**3**
2(e)(i)	4;	**1**
2(e)(ii)	29;	**1**
2(f)	*any two from:* M1 reduced growth (rates); M2 delayed or less, hatching (rates); M3 feeding stress / reduced feeding (rate) / reduced feeding success;	**2**

Question	Answer	Marks
3(a)(i)	stratosphere;	**1**
3(a)(ii)	*any four from:* M1 CFCs are **not** broken down in troposphere; M2 CFCs (move or rise into) stratosphere **AND** (CFCs) breakdown; M3 (CFC breakdown) due to ultraviolet or UV light; M4 then release, chlorine (atom) / C*l* (atom); M5 chlorine (atoms) / C*l* (atoms), breakdown ozone / O_3; M6 to form, oxygen (molecules) / O_2; M7 polar stratospheric clouds / PSC, provide surface for reactions; M8 polar vortex provides cold temperatures; M9 chlorine (atoms) / C*l* (atoms), remain in atmosphere / continue to destroy ozone;	**4**
3(b)(i)	*any three from*: M1 all agreements, **reduced** concentration or ODS / are effective; M2 Montreal 1987 (still) increases / **least** effective / not effective; M3 London, (still) increases / not effective; M4 Montreal 2007 decreases / **most** effective/is effective; M5 Copenhagen has decreases / is effective; M6 Montreal 1987 has constant (rate) of increase; M7 relevant data quote e.g. Montreal 2007 predicted to almost reach 1960 levels by 2100 / Montreal 2007 less than 1 by 2100;	**3**

Question	Answer	Marks
3(b)(ii)	*any one from:* M1 to show that the CFCs are human-made; M2 idea of comparing concentration ODS from human-made and natural sources;	**1**
3(c)(i)	*any three from:* M1 more UV reaching Earth's surface (in 2008 as most percentages are positive); M2 due to, ozone depletion / ozone hole; M3 ozone depletion greatest over Antarctica; M4 due to, colder temperatures / polar vortex; M5 due to, polar stratospheric clouds / PSCs;	**3**
3(c)(ii)	*any three from:* M1 cataracts; M2 cancer; M3 reduced photosynthesis / decreased crop yields; M4 loss of biodiversity; M5 degradation of construction materials or buildings; M6 degradation of clothing;	**3**

Question	Answer	Marks
3(d)	*total max 3 marks* *max two benefits:* M1 less greenhouse gases released (into atmosphere); M2 less global warming; M3 stated example of climate change impact reduction e.g. less sea level rise; *any two limitations:* M4 CO_2 still being released / does not encourage other companies to reduce their own emissions / companies continue to pollute; M5 (company selling may) limit how many carbon credits can be purchased;	**3**

Question	Answer	Marks
4(a)(i)	*any two from:* M1 biogas / biofuels, are renewable fuels; M2 the (residual) heat from the process is fed back to the heater / no additional energy needed; M3 stated example of how use of biochar reduces the use of non-renewable resources e.g. biochar does not need to be extracted from a quarry using equipment that runs on non-renewable resources;	**2**
4(a)(ii)	*any two from:* M1 carbon, capture / sink / store; M2 carbon stored for a long time; M3 replaces, non-renewable resources / fossil fuels;	**2**

Question	Answer	Marks
4(b)(i)	M1 axis labels: *y*-axis percentage of nitrogen **AND** *x*-axis biochar crop **AND** crop names; M2 sensible linear scale such that plotted points occupy at least half of grid; M3 5–6 correct plots; M4 bars drawn with ruler **AND** of equal width **AND** not touching;	**4**
4(b)(ii)	sorghum;	**1**
4(b)(iii)	3.7;	**1**
4(b)(iv)	sorghum;	**1**
4(b)(v)	*any two from:* M1 temperature; M2 humidity; M3 water; M4 oxygen; M5 salinity; M6 light;	**2**
4(b)(vi)	*any one from:* M1 (land or vegetation) not used for crops or food / reduced crop yield; M2 less food for livestock; M3 vegetation cannot be eaten;	**1**

Question	Answer	Marks
4(b)(vii)	*any one from:* M1 maintains fertile land / allows for good plant or crop growth; M2 improves food security; M3 more land can be used to grow crops; M4 stated economic benefit e.g. of selling biomass to make biochar; M5 sustainable practice; M6 can be used, as a fuel / to provide energy; M7 readily available;	**1**
4(c)	M1 uneven / scattered, distribution; M2 large area, in south / S / south east / SE / east / E; M3 large areas, either side / along, rivers;	**3**
4(d)(i)	key matches pie chart with shading AND labels;	**1**
4(d)(ii)	*any two from:* M1 homes / towns / roads / infrastructure / construction / urbanisation / industry / building; M2 mineral extraction / mining; M3 renewable energy e.g. hydroelectric / HEP / wind farms / solar power; M4 reservoirs / dams; M5 natural disasters e.g. storms / (wild) fires / floods / droughts / volcanoes;	**2**

Question	Answer	Marks
4(e)(i)	*any two from:* M1 first (species) to colonise; M2 small plants; M3 fast growing / quickly fills an area / spread fast; M4 short lived; M5 improves soil or stated example e.g. binds shallow or thin soil / improves soil structure / improves soil fertility / adds organic matter / improves water holding capacity; M6 tolerance to hostile conditions / stated example e.g. low pH or acid soils or can grow in soils with limited nutrients;	**2**
4(e)(ii)	climax (community);	**1**