



## Cambridge International AS Level

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**ENVIRONMENTAL MANAGEMENT**

**8291/23**

Paper 2 Management in Context

**May/June 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 May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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This document consists of **12** 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 '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.

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Question	Answer	Marks
1(a)	reactants: carbon dioxide + water; products: glucose + oxygen;	<b>2</b>
1(b)	<i>any two from:</i> provides enough food to feed the current / increasing population; more food can be grown in same area of land / intensification of food production; enables, stockpiling of food / surplus food; enables (improved) distribution of food;	<b>2</b>
1(c)	5.92 – 1.94 or 3.98; 205;	<b>2</b>
1(d)(i)	<i>any two from:</i> lack of money; limited access to energy / electricity / energy insecure; lack of (refrigeration), equipment / vehicles / infrastructure; less access to technological knowledge;	<b>2</b>
1(d)(ii)	<i>max [1] strategy stated or described:</i> <i>max [1] description to match strategy:</i> switch to low-carbon fuels; e.g. hydrogen use of hybrid vehicles / electric vehicles invest in renewable fuels; e.g. biofuel / bioethanol use of electric vehicles; reduces combustion of carbon-based fuel; reduces carbon dioxide emissions; grow food locally; no need for food to be transported;	<b>2</b>

Question	Answer	Marks
1(e)(i)	<p><i>benefits:</i> improved crop yield / quality; as less competition from weeds; less herbicides needed; as weeds are quickly killed; easier management for farmer e.g. no selective / special herbicide required;</p> <p><i>limitations:</i> encourages increased used of herbicides; leads to run-off; superweeds / weeds resistant to herbicide; loss of biodiversity as fewer weeds survive / reduces food or shelter for animals; contamination / cross pollination, between non-GM plants; GM seed is more expensive; farmers can't save GM seed, need to purchase again following year;</p>	<b>4</b>
1(e)(ii)	<p><i>any two from:</i> light surfaces reflect more heat than dark surfaces; greater albedo means more of the incoming solar radiation is reflected back into space; ORA less incoming solar radiation is absorbed reduces (Earth's absorbed) heat (energy); temperature of planet decreases;</p>	<b>2</b>

Question	Answer	Marks
2(a)(i)	6;	<b>1</b>
2(a)(ii)	<p>sensible linear scale and data occupying over half the grid; axes labels AND unit; e.g. y-axis label:( mean) number of frogs AND x-axis: artificial light / hours per day 5 correct plotted points <math>\pm</math> half small square; bars of equal width that are not touching;</p>	<b>4</b>
2(a)(iii)	anomalous result / outlier;	<b>1</b>

Question	Answer	Marks
2(a)(iv)	<i>any one from:</i> the more <b>artificial</b> light per day the fewer the number of adult frogs; tadpoles are less likely to mature into adult frogs with artificial light;	<b>1</b>
2(a)(v)	<i>any one from:</i> do not know the original number of eggs; each female may lay different numbers of eggs; small sample of frogs / only five frogs sampled;	<b>1</b>
2(b)	stated size of quadrat e.g. 1 m × 1 m quadrat; stated sampling distances e.g. every 5 metres / systematic e.g. every metre OR distances selected at random; count number of frogs (in the quadrat); repeat AND take an average;	<b>4</b>
2(c)(i)	not representative / all in one place;	<b>1</b>
2(c)(ii)	288;	<b>1</b>
2(d)	<i>any two from:</i> can survive in conditions other frogs cannot; outcompetes other frogs; produces a lot of eggs; accidental introduction (by humans); no predators;	<b>2</b>
2(e)	<i>any one from:</i> temperature; humidity; water; oxygen; light; pH;	<b>1</b>
2(f)(i)	snake;	<b>1</b>
2(f)(ii)	4th;	<b>1</b>

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Question	Answer	Marks
2(f)(iii)	decrease population AND, more predators / more are eaten;	1

Question	Answer	Marks
3(a)	<i>any two from:</i> west coast of South America; west coast of Mexico; west coast of Central America; south tropic of Cancer; north/ south tropic of Capricorn; east Pacific <u>Ocean</u> ; north and south of equator;	2
3(b)	<i>any two comparisons from:</i> NW Atlantic population increasing AND E Pacific decreasing overall; past-present: NW Atlantic gradual increase AND E Pacific (gradual) decrease; present-future: sharp increase from present to future for NW Atlantic AND E Pacific (gradual) decrease; comparison of trend with both populations from past / present / future;	2
3(c)(i)	<i>any two from:</i> more, greenhouse gases / carbon dioxide / methane in atmosphere; which absorb infrared radiation; increased (enhanced) greenhouse effect / global warming;	2
3(c)(ii)	<i>impact: (population decrease or increase) with any two valid reasons:</i> greater number of females : males in the population; limited number of (suitable males) mates;  higher temperatures may damage eggs; one male can mate with many females;	2



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(c)(iii)	<p><i>any one impact and one reason:</i>            rising sea level / extreme weather;            wash eggs away;            habitat loss;            loss of food sources;            more invasive species;            greater competition / predation;            possible migration;            ocean acidification;            too acidic loss of food source of turtles;            AVP;</p>	<b>2</b>
3(c)(iv)	<p><i>any one from:</i>            legislation;            use line fishing instead of nets;            no fishing in areas where turtles live;            education / awareness of dangers of trapping turtles in nets;</p>	<b>1</b>
3(d)	<p><i>max [3] benefits from:</i>            no predation;            diseases / illnesses can be treated;            prior selection of mates;            allows research of species;  <i>max [3] limitations from:</i>            expensive;            difficult to support a large breeding programme;            behaviour / breeding / eating pattern, of captive animals may be affected;            conditions may never be suitable to release animals;            eggs have to be harvested from the wild;            AVP;</p>	<b>4</b>

Question	Answer	Marks
4(a)(i)	<p><i>any five from:</i>            CFCs are not broken down in the troposphere;            CFCs move into the stratosphere;                breakdown in the presence of UV light;                to release a chlorine / Cl atom;            rapid reactions between chlorine atoms and ozone / O<sub>3</sub> form oxygen / O<sub>2</sub>;            chlorine atoms remain in stratosphere and continue to destroy ozone;</p>	<b>5</b>
4(a)(ii)	<p>an area (in the stratosphere) where the (average) concentration of ozone is less / depleted;            than 100 Dobson units;</p>	<b>2</b>
4(b)(i)	<p><i>max two data use from:</i>            compared to CFCs, all lower GWP / ORA;            quoted data: e.g. HFC-134a is 7 times less than CFC-12;  <i>max three impacts from:</i>            contribute less to, climate change/global warming;                less stated effect e.g. sea level rise;            oxides of nitrogen leads to acid rain;                stated effect e.g. damage crops / buildings;</p> <p><b>max [4]</b></p>	<b>4</b>
4(b)(ii)	<p><i>any three from:</i>            initial evidence was not accepted / lack of initial experiment evidence;            many appliances contained/used CFCs;            no immediate replacement;            gives time for countries to, implement ban / prepare for changes;            cost implication;            industry reluctance;            would have led to inequality in LIC and HICs;            no international agreement / Montreal agreement was not in place;            AVP;</p>	<b>3</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)(i)	<p><i>any three from:</i>            greater population;            urban compared to rural;            greater use of open fires;            more cars used / more combustion of fossil fuels;            more industry;            wind circulation patterns;            wildfires;            reliance on biomass (for energy source);</p>	<b>3</b>
5(a)(ii)	<p><i>any one from:</i>            difference in economic activity;            lack of access of electricity to power monitoring stations;            difference in pollution monitoring priorities / different legislation e.g. laws;            AVP;</p>	<b>1</b>
5(b)	<p><i>max [3] benefits:</i>            novel approach raises awareness of the issue of air pollution;            residents can avoid pollution hotspots;            data available in real time;            birds can reach inaccessible / remote places;  <i>max [3] limitations:</i>            using birds maybe considered cruel / air pollution may harm pigeons;            difficult to fit to birds;            cannot control where the birds fly;            equipment lost if birds do not return/ monitor lost in flight;            only three pollutants monitored;            not everyone has access to social media;</p>	<b>4</b>
5(c)(i)	<p><i>any two from:</i>            mixture of air pollutants and particulates;            example of pollutant; e.g. ground level ozone;            reaction in presence of sunlight;</p>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(c)(ii)	<i>any two from:</i> decreased crop yields; deterioration of plastics / rubber; AVP;	<b>2</b>
5(c)(iii)	<i>any three from:</i> safe storage / disposal of household products (containing VOCs); legislation; polluter pays principle; restricted vehicle use in urban areas / use of electric cars;	<b>3</b>