Cambridge Assessment International Education

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT **8291/22**

Paper 2 Management in Context **October/November 2023**

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 2023 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 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)(i)	*any two from:* reflect (incoming) solar radiation / (sun)light, back into space; before it reaches the Earth's surface; reduces global temperatures;	**2**
1(a)(ii)	*any two from:* increases, albedo / reflectivity (of plants / Earth's surface); reflect (incoming) solar radiation / (sun)light, back into space; reduces global temperatures;	**2**
1(b)(i)	*any two from:* changed (wind/atmospheric) circulation; adverse effect on rainfall / too much rain / too little rain; changed temperatures; more extreme weather conditions e.g. hurricanes / storms / heatwaves;	**2**
1(b)(ii)	*any two from:* *Positives:* both strategies reduce global temperatures; *Negatives:* both strategies cause adverse effects e.g. floods / drought; many people adversely impacted (due to floods / droughts) e.g. relocation; more people adversely impacted by spraying aerosols than growing crops with shiny leaves / 3 billion (aerosols) versus 1.4 billion (shiny leaves); but need to fix climate change regardless of cost;	**2**

Question	Answer	Marks
1(b)(iii)	*any one from:* laboratory / small scale testing; field testing; repeat the (computer) models with different parameters e.g. measure, humidity / greenhouse gas concentration or named greenhouse gas;	**1**
1(c)	**axis labels**: y-axis number of people / million **AND** x-axis country; sensible linear scale to cover at least half the grid; bars equal width **AND** not touching; four or five correct plots;	**4**
1(d)	*any three from:* (flooding) contaminates / pollutes, water bodies; stated examples of contamination / pollution e.g. sewage / industrial waste / domestic waste / agricultural waste / fertilisers; water, cannot be drunk / is unsafe; (flooding can lead to) saltwater / seawater intrusion; damage to, infrastructure / distribution pipes / tanks (so distribution adversely affected);	**3**
1(e)	*any three from:* plants / crops, need water for growth; by photosynthesis; (lack of water) reduces crop yield / loss of crops / loss of livestock; leads to famine / starvation; leads to food insecurity;	**3**
1(f)	*any three from:* majority south of Tropic of Cancer; some north of Tropic of Cancer; between Tropic of Cancer and equator; underweight children in Africa / (South) Asia; relevant quoted country / data e.g. high in India or Indian sub-continent / low in Americas;	**3**

Question	Answer	Marks
2(a)(i)	concentration of sulfate ions;	**1**
2(a)(ii)	*any one from:* volume / amount, of water collected; time of day sample collected; depth of collection; sample location e.g. side of lake;	**1**
2(a)(iii)	*any four from:* volume / amount, of water collected; time of day sample collected; depth of collection; sample location e.g. side of lake; method of choosing location; method for measuring sulfate concentration; reagents / colour to identify concentration;	**4**
2(b)(i)	236.6; 237;	**2**
2(b)(ii)	171;	**1**
2(b)(iii)	Yes **AND** higher / highest concentrations on wet days / low on the dry day; OR No / can't be sure **AND** only one dry day / not enough data;	**1**
2(b)(iv)	*any one from:* repeat **AND** find average / mean; increase number of samples; record volume of rain that falls / more samples from dry days;	**1**
2(c)(i)	5.6;	**1**

Question	Answer	Marks
2(c)(ii)	*any three from:* sulfur (impurities) in fossil fuels; combustion of fossil fuels / cars / vehicles; produces / emits, (atmospheric) sulfur dioxide / SO_2; sulfur dioxide / SO_2 reacts with water / H_2O **AND** oxygen (in atmosphere); to form sulfuric acid / H_2SO_4;	**3**
2(c)(iii)	*any two from:* defoliation / yellowing or browning of leaves / leaf damage / plants have holes; reduced / delayed, plant growth or plants weakened; reduced crop yield / less crops;	**2**
2(c)(iv)	*any three from:* North America and Europe both decrease (after 1972-1975); Europe highest emitter (until 1990); East Asia and Middle East increasing; North America / Europe / East Asia, fluctuate; relevant quoted comparative data; qualitative comparative of 2 or more regions;	**3**
2(c)(v)	*any two from:* emissions produced globally / international problem; no borders in atmosphere; emissions travel between countries close to each other; need, international agreements / global cooperation;	**2**

Question	Answer	Marks
3(a)(i)	*any three from:* methane / carbon dioxide, are greenhouse gases; leads to, global warming / climate change; (growing new varieties) reduces carbon footprint; rice eaten by very large number of people / rice is a staple food; (growing new varieties) mean less water used / increases water security;	**3**
3(a)(ii)	*any one from:* no need to irrigate; farmers familiar with this method / traditional method; terracing prevents soil erosion; can be grown on limited / poor quality soil; water contains nutrients; high yield (per unit area);	**1**
3(b)(i)	*any two from:* size / area (of field); soil type; soil pH; moisture content of field; salinity / soil fertility;	**2**
3(b)(ii)	C **AND** lowest yield / mass per ha;	**1**

Question	Answer	Marks
3(b)(iii)	***total max four:*** *any **one** from:* *random sampling described:* sample sites selected using grid and use a random number generator; OR *systematic sampling described:* divide the field into grid / transects and select every nth square / transect; *any **two** from:* *method of sweeping:* walk slowly up/down rows or across field; sweep from side to side / sweep through 180°; use one sweep per step; avoid thorns/sharp bushes; sweep upper part of plant; count the number of insects / average number of insects; *any **one** from:* *method of stopping insects escaping:* turn the net so opening is face down / hold net closed above contents; let bottom of net drape over edge of a frame (to trap insects in net);	**4**
3(b)(iv)	*any two from:* some insects, missed / escape; insects missed close to, soil / ground; difficult to use in, water / paddy field; does not work well in short or dense vegetation; net is easily damaged; time consuming / hard work;	**2**

Question	Answer	Marks
3(b)(v)	***total max four:*** ***max [3]* advantages*:*** effective / efficient; quicker method / less labour intensive; prevents decrease in crop yield; reduces chance of food insecurity; do not need to reintroduce a predator; biological control can become invasive; ***max [3] disadvantages:*** affects non-target species / soil organisms; affects pollinators; can become resistant to insecticide; can enter water bodies / can enter food chain / bioaccumulation described / biomagnification described;	**4**
3(b)(vi)	N = 541; grasshopper = 0.095 **AND** earwig = 0.182 **AND** aphid = 0.0079 **AND** thrip = 0.031; $\sum\left(\frac{n}{N}\right)^2$ = 0.316 / 0.32; D = 0.684 / 0.68;	**4**

Question	Answer	Marks
4(a)	***Total max five:*** ***max [4] advantages****:* electric cars do not emit carbon dioxide; which is a greenhouse gas; less impact on, climate change / global warming / air pollution; lower running costs / cheaper or free parking / cheaper to maintain; subsidies for, purchasing car / installing charging; easier to get around in towns / can use bus lanes / no congestion charge; reduced noise pollution; ***max [4] disadvantages:*** electricity for charging comes from burning fossil fuels **AND** this releases CO_2 / greenhouse gases; batteries made with energy from combusting fossil fuels / high amount of energy or raw materials (lithium) needed to produce batteries; (charging) infrastructure currently not widely available; contamination issue from disposal of batteries; short travel distance / short battery range / batteries do not last long (need repairs) / batteries take long time to charge;	**5**
4(b)(i)	*any one from:* get large amount of information; time consuming / difficult, to process answers;	**1**
4(b)(ii)	 ;	**1**
4(c)(i)	62 000;	**1**
4(c)(ii)	42;	**1**

Question	Answer	Marks
4(c)(iii)	*any two from:* percentage (of electric cars) takes into account the total number of cars; can compare between countries / shows the differences between countries; more accurate representation of the use of electric cars (in a country);	**2**
4(d)(i)	*any two from:* fossil fuel depletion; inequality in global energy resources; population growth; differing energy needs; climate change; delays or disruption in supply; reliance on imports; reliance on one form of energy; war / conflict;	**2**
4(d)(ii)	*any two from:* increased prices for, fuel / energy; increasing cost to industry; job losses; economic recession / decreased economic wealth / slowed economic growth / unstable economy; increased poverty / lower standards of living; reliance on price set by other countries (as energy imported);	**2**