

# Cambridge International AS Level

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**ENVIRONMENTAL MANAGEMENT****8291/21**

Paper 2 Management in Context

**May/June 2024**

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 2024 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 **16** 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 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.

Question	Answer	Marks
1(a)	<p><i>any two from:</i> comparative idea of different level of economy;</p> <p>Nigeria, recycles water / wastes less water / ora USA;</p> <p>Nigeria large(r) agriculture sector / economy based on agriculture / ora USA;</p> <p>Nigeria small(er) industry sector / less reliant on industrialisation / less industrialisation / less investment in industry / ora USA;</p> <p>idea of restrictions on water usage in stated sector <b>AND</b> country / ora;</p> <p>idea of more efficient appliances in stated sector <b>AND</b> country / ora;</p>	<b>2</b>
1(b)	<p><i>any three from:</i> causes illness or named illness / diarrhoea / cholera / named disease;</p> <p>cannot farm or work / leads to loss of earnings;</p> <p>time is needed to find clean drinking water;</p> <p>idea of cost of, buying clean water or treating water;</p> <p>idea of cost of medical treatment;</p> <p>idea of shortage of water leading to conflict;</p> <p>idea of contaminated water cannot be used to grow crops <b>AND</b> link to impact e.g. which then have to purchased or cannot be sold or food prices increase;</p> <p>idea of needing to move to a different area;</p>	<b>3</b>
1(c)	well that starts in <b>surface</b> layer and ends in <b>either</b> water layer;	<b>1</b>

Question	Answer	Marks
1(d)	<p><i>any two from:</i>  collects or uses rain water / rain water is recycled / rain water catchment / stores water;    can be used for, irrigation / crops / washing clothes;    reduces use of domestic water supply / reduces use of ground water;    can be used for drinking water after treatment;    water can be used during a drought;    idea of lower cost as not buying treated water or paying for water;</p>	<b>2</b>
1(e)	ice sheets / glaciers / lakes / rivers / permafrost;	<b>1</b>
1(f)	<p><i>axes labelled with unit for y-axis:</i>  x-axis: year <b>AND</b> y-axis: (mean) concentration <b>AND</b> (arbitrary) units;    sensible linear scale for both axes with plotted points that cover at least half of grid;    8–9 plots correct;    all 10 plots correct;    straight line drawn with ruler between each point <b>AND</b> not extrapolated back to zero or beyond year 10;</p>	<b>5</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(i)	<p><i>any one from:</i></p> <p>prices can be increased (by other country);</p> <p>lack of self-reliance / reliance on other countries / idea of imbalance of supply and demand;</p> <p>not sustainable;</p> <p>stated economic impact (e.g. cost of transport / cost of importing / impact on UK timber industry);</p> <p>energy use of transport or using vehicles / transport has carbon footprint / atmospheric impact of use of transport / named air pollution linked to transport;</p> <p>may introduce, invasive species / disease;</p>	<b>1</b>
2(a)(ii)	<p><i>any two or one developed from:</i></p> <p>livestock cannot graze on land / less space for livestock;</p> <p>food or crops, not grown or less grown / less yield or less space for food or crops;</p> <p>leads to food insecurity;</p> <p>long lead time / timber harvest will not be available for many years / trees take a long time to grow;</p>	<b>2</b>
2(b)	<p>reference to (trees) photosynthesis;</p> <p>trees remove or store, carbon dioxide / carbon dioxide reactant (in photosynthesis) / carbon dioxide + water (→ glucose + oxygen);</p>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(c)	<p><i>any three from:</i>  road separates or fragments the forest or habitat / one side of the forest is cut off by a road / road separates animals or organisms;</p> <p>power lines / pylons, separate or fragment forest / pylons separate animals or organisms;</p> <p>no access to the lake / animals have to cross the road to reach the lake;</p> <p>loss of trees at <b>edges</b> or barren land around <b>edges</b> of forest or <b>edges</b> road;</p>	<b>3</b>
2(d)(i)	<p>idea of most in, (north) Scotland / north / few in England <b>AND</b> Wales;</p> <p><i>any one from population:</i>  dispersed / scattered / spread out;</p> <p>more along coast / more west (Wales) / few in east / few in central England or in centre / cluster south (England);</p>	<b>2</b>
2(d)(ii)	<p><i>any three from:</i>  public are not experts / misidentification / wrong species counted;</p> <p>bees, may be missed / counted more than once / move around / difficult to see / difficult to get close to / miscounting / inputted incorrectly / counting errors / error in remembering number counted;</p> <p>no details on how the sightings were made e.g. random / systematic / stated conditions e.g. weather, temperature;</p> <p>some areas give more or less returns / no information on number of people reporting / no information on number of bees;</p> <p>difficulty in finding map grid reference / location may not be correct / wrong grid;</p> <p>need access to, smartphone / computer / internet;</p>	<b>3</b>



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(e)	<p><i>for max [4] at least one from each section (method, repeat, estimation) plus any other marking point:</i></p> <p><i>method:</i> count the bees observed / count bees (along transect or line);  within stated distance either side <b>or</b> along transect or line; e.g. 2 m</p> <p><i>repeat:</i> repeat at different times (of day / year);  repeat complete investigation AND average;</p> <p><i>estimation:</i> idea of scaling up e.g. determine number of bees in 1 m or 1 m<sup>2</sup> and multiply by total area;</p>	<b>4</b>

Question	Answer	Marks
2(f)	<p><i>any five from:</i>  <i>artificial hives / ORA natural nests:</i>  bees may not adapt to artificial hives / hives might not be suitable to bees' needs;  quality or quantity of honey may be different / different productivity in artificial hives;  idea of cost of artificial hives;  conditions controlled;  bees can be, fed / given water;  hives can be cleaned;  disease can be treated;  easier to collect honey / hive in convenient location / ease of maintenance or monitoring (for beekeeper);  can hold larger population / hives are larger than nests / fixed size;  last longer / more durable;  protects from predators;</p> <p><i>sun hive:</i>  <b>tree</b> or <b>location</b> same as nest / <b>location</b> is in natural habitat;  similar shape to natural nest;  can get blown away / damaged by wind or weather / at risk due to deforestation;</p> <p><i>wooden hive:</i>  easier to monitor at ground level;  wood destroyed by termites / wood rots;  AVP;</p>	5
2(g)	<p><i>any three from:</i>  (out)compete for, habitat / nesting sites / shelter / territory;</p> <p>(out)compete for stated resources e.g. food / disrupt food chain;</p> <p>carry disease;</p> <p>breed quicker (than bees);</p> <p>predators of bees / prey on bees;</p> <p>no known predators (for hornets);</p>	3

Question	Answer	Marks
3(a)(i)	<p><i>any two from:</i> methane is a greenhouse gas / increase in greenhouse gases;</p> <p>(increase in enhanced) greenhouse effect;</p> <p>increase (global) temperature / climate change;</p>	<b>2</b>
3(a)(ii)	<p><i>any two from:</i> rice fields or paddies;</p> <p>livestock or named livestock (digestion);</p> <p>landfill;</p> <p>decomposition of vegetation / rotting of vegetation;</p> <p>released from melting permafrost;</p> <p>peat (bogs) / wetlands;</p> <p>mining / rock extraction / fracking;</p>	<b>2</b>
3(b)(i)	<p><i>successful because:</i> emissions decreased; no areas greater than 18 000 tonnes (in 2020) / idea of reduction in emissions in east / no 270 000 tonne emissions in 2020</p> <p><i>less successful because:</i> increase in emissions on west (coast);</p>	<b>3</b>
3(b)(ii)	<p>(in the atmosphere SO<sub>2</sub>) reacts with (rain)water (and oxygen);</p> <p>forms sulfuric acid;</p>	<b>2</b>
3(b)(iii)	<p><i>wet acid deposition:</i> snow / rain / hail / fog;</p> <p><i>dry acid deposition:</i> dust / gas(es);</p>	<b>2</b>

Question	Answer	Marks
3(b)(iv)	<p><i>any three from or developed responses:</i>            use of renewable resources / stated example e.g. solar;</p> <p>fuel desulfurisation;</p> <p>flue gas desulfurisation;  <i>description</i>            gases dissolved in water;            neutralised/reacted/removed with limestone or calcium carbonate or CaCO<sub>3</sub>;</p> <p>electrostatic removal (from emissions);</p> <p>catalytic convertors;</p> <p>restricting vehicle use / electric cars or EVs / use public transport / car pooling / idea of encouraging walking or cycling;</p> <p>international agreements / legislation / clean air zones / limits on emissions from factories;</p> <p>polluter pays principle / fines;</p> <p>idea of education or raising awareness;</p>	<b>3</b>
3(c)(i)	keep soil the same / same consistency / same composition / even distribution (of nutrients or particles or minerals);	<b>1</b>
3(c)(ii)	<p><i>any one from:</i>            pH of non-acid deposition;</p> <p>compare results with non-acid rain;</p> <p>control;</p>	<b>1</b>
3(c)(iii)	pH (of water);	<b>1</b>
3(c)(iv)	identify anomalous result or outlier / trend can be identified / reduce impact of anomalous results / determine a mean;	<b>1</b>
3(c)(v)	fair test / results are comparable / amount of water in each leaf is <b>variable</b> (in different plants or leaves);	<b>1</b>

Question	Answer	Marks
3(c)(vi)	<p><i>any one from:</i> acid precipitation reduces crop yield;  the lower the pH the lower the yield;  the more acidic the pH the lower the yield / ORA;  the greatest reduction in yield was for pH 3.0;  highest yield at pH 6.0 / higher pH gives higher yield;</p>	1
3(c)(vii)	10.92;	1
3(c)(viii)	<p><i>any one from:</i> pH 3.5 and lower damages leaves;  pH 4.0 and higher does not damage leaves;  the more acidic / the lower the pH, the more damage / ORA;  pH 3.0 / lowest pH, causes most damage;  damage increases as pH decreases;</p>	1

Question	Answer	Marks
4(a)(i)	<p>correct plot at 21 000 000;  bar same width <b>AND</b> not touching other bars <b>AND</b> same distance between bars;</p>	2
4(a)(ii)	<p>correct reading from bar chart / 39 200 000;  reading <math>\div</math> 2194;  17 867;</p>	3

Question	Answer	Marks
4(a)(iii)	50;	<b>1</b>
4(a)(iv)	<p><i>any two economic factors from:</i> availability of jobs / idea of average income from jobs;</p> <p><i>availability or cost of:</i> infrastructure / transport links / communication links;</p> <p><b>stated</b> resource e.g. food / water / energy;</p> <p>housing;</p> <p>healthcare;</p> <p>education;</p> <p>taxes;</p>	<b>2</b>
4(b)(i)	<p><i>(0–14) + (65+) value on <b>top</b> of sum: 52 298 419</i> <b>OR</b> <i>(aged 15–64) value on <b>bottom</b> of sum: 73 209 053;</i></p> <p>71(.4370926)</p>	<b>2</b>

Question	Answer	Marks
4(b)(ii)	<p><i>any three from doesn't take into account:</i> students (over 15) / people who work before 15;</p> <p>people cannot work due to ill health / illness;</p> <p>people cannot work due disability;</p> <p>non-working parents / people on paternity or maternity leave;</p> <p>early retirement / stop working before 64;</p> <p>working beyond age 64;</p> <p>harder to get a job at lower or upper ends of range;</p>	<b>3</b>
4(b)(iii)	<p><i>any three from:</i> ageing population / more old people;</p> <p>lower tax revenue;</p> <p>higher pension or retirement spending needed;</p> <p>pressure on healthcare / increase healthcare / more carers (for elderly) / more nursing homes / more medical facilities (needed for elderly);</p> <p>pressure to raise retirement age;</p> <p>pressure on named resources e.g. energy / water / food;</p> <p>people may work longer / working age will increase;</p>	<b>3</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(c)	<i>any three from:</i> (availability or cost of) contraception;  education about contraception;  improved education for women / more opportunities for woman;  availability or improved or cost of health care;	<b>3</b>